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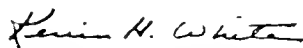
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For more than 200 years, Boston was able to accommodate new growth and development through massive landfill projects. In this century, construction of high-rise buildings in our downtown enabled Boston to experience vigorous economic expansion. And in recent years, we have seen the development of new residential areas by imaginative recycling of old mercantile buildings to new housing units. But it is obvious that a city as compact as Boston — and a city whose economy is the engine for the entire metropolitan area — must exercise great resourcefulness in balancing the need for growth with the equally important task of protecting our environment.

This report represents the start of a comprehensive planning process that seeks to manage growth and development in Central Boston. This initial document, containing extensive background data on the downtown economy and growth patterns, provides insight into what patterns we might anticipate in the future.

It is my hope that this report will generate public dialogue that will, in turn, lead to guidelines that protect Boston's character and scale. At the same time, this is a planning process that will also allow us to direct development of new workspace and residential areas towards those parts of downtown which can accommodate additional development.

In documenting Boston's remarkable rebirth, the report provides forecasts for the future and sets forth the complex issues of growth facing Boston. And out of this process — with the collaboration of interested groups and individuals — will emerge the guidelines and principles and concepts that assure us of a vital, distinctive city in the years ahead.



Kevin H. White, Mayor
City of Boston

In spirit and substance this is a report geared to Boston's future. It examines the recent past to determine how the central city has changed and describes the potential for growth in the next ten years. Yet on another level this is a report that addresses a larger question — what kind of city can Boston be?

In one generation we have seen Boston's economy shift from one based primarily on trade and manufacturing to one where finance, business, and professional services now predominate. This economic change has been accompanied by a dramatic improvement in our built environment. Increasingly, Boston has become a more attractive city to live in, a city that draws more and more shoppers, tourists, and convention visitors. Boston, in short, has gone through an era of great change, but Boston has also reinforced its historic role as a center of commerce and culture.

So while this study focuses on the future, it is a plan that integrates an understanding and appreciation of our rich past in charting directions for the Boston of tomorrow.



Robert J. Ryan, Director
Boston Redevelopment Authority





Central Boston Study Area Boundaries

Last year more dollars were invested on a per capita basis for urban development in Boston than in any other city in the country, and substantial investment is expected to continue throughout this decade. This urban growth and change — an economic resurgence encompassing office, hotel, retail, industrial, and residential development — symbolizes a strong local economy with a growing job base and relatively low unemployment.

But changes such as those underway in Boston today are not unique. The evolution from agricultural trade, to manufacturing, to service-based centers has altered the complex relationships of social, economic, and environmental factors which shaped Boston in the past and which shape other cities as well.

What distinguishes Boston's current economic transformation is the rate and magnitude of change. New construction since 1975 has added over fourteen million square feet of space to the physical inventory of Boston, with a record amount of office space built and notable increases in the number of hotel rooms and in the square footage of institutional space.

If economic growth in Boston continues throughout the decade, development required to meet future needs could dramatically alter the cityscape. Expansion within the office sector alone could initiate the construction of eight buildings the size of Sixty State Street between 1985 and 1992; this is in addition to the over six million square feet of office space scheduled for completion by 1987.

Such rapid growth raises anew — and with greater urgency — questions about the relationship of future development to the urban design and quality of life in the city. How should Boston manage this growth to expand employment and housing opportunities, to improve the City's fiscal profile, and to maintain the city's unique character and quality of life?

As the public agency responsible for the physical planning and development of the city, the Boston Redevelopment Authority (BRA) has initiated a study — Boston Tomorrow — to examine the effects of recent development, to forecast future growth, and to establish policies for guiding development over the next decade. The study focuses on the central part of Boston, Boston Inner Harbor, and its waterfront. (Parts of the city not included in the study area boundaries are within the planning jurisdiction of Boston's Neighborhood Development and Employment Agency.)

Central Boston is the area of the city undergoing the most substantial development. It is within Central Boston's boundaries that most of the city's commercial and institutional uses are located, as well as much of its rental housing. The area contains over eighty percent of Boston's office space and its three major retail districts. More than half the city's manufacturers and manufacturing jobs are located in Central Boston, as are nearly all of the major educational and medical institutions and visitor-related facilities. Forty percent of the city's apartments and the same percentage of its mixed commercial/residential properties are within the study area boundaries.

Changes in the development process necessitate a process such as the Boston Tomorrow study. For the past two decades, much of Boston's development was managed by the BRA under the Federally-funded Urban Renewal Program. As part of that program, development guidelines provided specific controls on the urban design and architecture of designated areas, including Government Center and the Waterfront. Now that Urban Renewal is no longer a major force shaping the city, most new development results from private initiatives, and is located on sites not governed by Urban Renewal's detailed guidelines.

To maximize the benefits of future development and to minimize the adverse impacts, the City needs to formulate new development guidelines — the purpose of the BRA's study. The guidelines will assist BRA as it continues to guide development in Central Boston through its review of development proposals. Such review affords the City the opportunity to manage the impacts of new development in a more comprehensive manner than the zoning process alone would allow. Through its review, the BRA can stipulate design controls, as well as negotiate special agreements which benefit the City, such as the provision of housing, parks, or other public amenities.

The process of formulating development guidelines will consist of two phases. The first phase — this document — presents information on recent development in Central Boston, projections for future growth, and issues to address through development guidelines. The report is organized around the major categories of land use — office, commercial, industrial, institutional, and residential — and the impacts of current and future development of those uses on urban design, environmental quality, energy, infrastructure, and employment. (A companion report, "Boston Tomorrow: Background on Development", provides similar information with more extensive documentation of the changes described here.)

The second phase of Boston Tomorrow will result in a set of development guidelines representing the BRA's strategy for managing growth in the coming decade.

Complementary studies, as well as public input, will enhance the process of formulating development policies. Several of the studies were initiated or co-sponsored by the BRA. One, "The Downtown Crossing Economic Strategy Plan", was recently completed and provides guidance for improving the Downtown retail area. "The Commercial Palace District" is a second development-related study. Co-authored by the Boston Landmarks Commission, the study recommends establishing a National Register historic district Downtown. The first phase of another study, "Parking in Central Boston", was also recently completed. The study analyzes the impacts of new development on the parking supply and suggests how to meet the new demand. A fourth study, "The Central Boston Development Capacity Report", will assess the area's physical ability to absorb new development. In addition, the Greater Boston Chamber of Commerce, through its Boston 2000 Committee, has undertaken a major project to identify development issues facing the City and to seek solutions for them. The "Goals for Boston" project is another effort to establish priorities for Boston's future. Input from all these studies and from public participation noted in the final section of this report will help the City to formulate development strategies for the future.



Boston's relatively new skyline symbolizes the city's transformation from a center of mercantile trade to one whose economic base has become more diversified with the rapid employment growth in finance and business. The office industry, especially finance, insurance, real estate, and business and professional services, fueled the once sluggish local economy, contributing to the revitalization of Boston over the past two decades.

Central Boston, the focus of this study, is the area of the city undergoing the most substantial economic and physical change. Since 1975, approximately fourteen million square feet of commercial and institutional space has been constructed downtown, five times the amount built in the previous thirty-five years. In addition, seven million square feet of commercial, institutional, and mixed-use space was rehabilitated. Many of the rehabilitated structures are eligible for or are listed on the National Register of Historic Places; their renovations have contributed to Boston's architectural distinction.

Employment growth has accompanied the substantial development activity downtown: the number of jobs in Central Boston increased by nearly forty thousand between 1976 and the beginning of 1983. Employment gains in Central Boston, where over half the jobs in the city are located, have helped to increase the city's total employment after the mid-1970s recessionary decline. Today there are nearly 550,000 jobs in Boston. Although employment in retail trade and manufacturing have been stable in recent years after several decades of decline; finance, business, and professional services have generated most employment growth downtown. Office jobs have accounted for nearly fifty percent of the new jobs downtown since 1976. Institutional employment gains have also been significant and have added over thirty percent of the new jobs in the past six years.

Employment growth has meant an additional eighteen thousand jobs in Central Boston for residents of the city. With the increase in white collar occupations (professional, technical, and managerial positions), Boston's resident work force in such jobs grew by nearly ten percent between 1970 and 1980. At present, Boston residents hold only one out of every three jobs in the city. Boston's goal is to capture one out of every two new jobs for city residents. Mayor Kevin White's 1979 Executive Order (upheld by the U.S. Supreme Court in 1983) which established a resident jobs program will help to achieve that goal.

Simultaneous with the economic and physical evolution of Boston, the characteristics of the city's population are also changing. One demographic trend is a decline in the city's total population between 1970 and 1980. However, with fewer persons per household than a decade ago, the number of households has remained constant. A second trend is the increasing diversification of the racial composition of Bostonians; a higher percentage of blacks and hispanics now live in the city. A third trend is the changing age structure of the population. The number of youths aged five to fourteen has declined; and the number of adults aged twenty-five to thirty-four has increased. The Joint Center for Urban Studies and Planning of MIT and Harvard in its report, "Future Boston: Patterns and Perspectives", has predicted that the population of Boston could continue to decline if the average household size decreases further and if the housing stock is not expanded. Changing lifestyles, such as increases in the number of divorcees and people living independently, and the suburban migration of families with children, are among the trends which are likely to contribute to the decline in household size and population. "Future Boston" also predicts that the racial composition of Boston's population

will become more diverse. The number of adults between the ages of thirty-four and forty-four is expected to grow as the baby boom generation matures, a factor which could create additional demand for housing and jobs in the city.

Some demographic trends in Central Boston depart from those found city-wide. Central Boston's population increased by five percent between 1970 and 1980; the number of households grew substantially, in contrast to a fairly constant level throughout Boston. The number of people over sixty-five years of age fell by fifteen percent while it remained constant city-wide. The percentage of minorities living in Central Boston grew but at about half the rate of increase found throughout the city. The average household size and the number of young adults living in Central Boston approximates the city-wide figures. As the residential section of this report notes, trends also vary among the neighborhoods, and the variations can have different implications for housing in each of Central Boston's neighborhoods.

The sections which follow deal with Boston's prospects for growth, describing the current status of the city's office, retail, industrial, institutional, and residential sectors and forecasting their future development. Changes within each sector have given rise to issues which the City will address through its development strategy and guidelines. As well, changes of the magnitude Boston is currently experiencing and is likely to see in the coming decade will have very real impacts on the shape of the city, on the quality of the environment, and on the capacity of the city's energy, transportation, sewerage, and water systems. Sections describing each of these — urban design, environmental quality, energy and infrastructure — provide background information useful to consider in managing the impacts of future development in Central Boston.



Office Development

The office sector, principally finance, business and professional services, has assumed a leading role in the creation of employment in Boston during the past twenty years, and office employment growth has helped to maintain the local economy when employment in manufacturing and trade declined. Today nearly half the jobs within the city are office-based, as are over half the jobs located in Central Boston. Total office employment in privately-owned space downtown has risen by more than fifty percent since 1976 to its current level of approximately 175,000 jobs. Office employment has accounted for over sixty percent of the net new jobs downtown since 1976.

The boom in office construction has come to symbolize the resurgence of the city's economy. The private office stock in Central Boston increased by over sixty-five percent, from approximately twenty-two million square feet in 1960, to approximately thirty-nine million square feet by 1983.

The City's Federally-funded Urban Renewal program, in concert with dramatic employment growth in the finance and business sectors of the local economy, fueled much of this new development. Even in the absence of Urban Renewal funds, construction of office space has continued. Between 1974 and the beginning of 1983, approximately 8.5 million square feet of office space has been completed.



Several factors account for the projected demand for additional office space in Boston. First, employment growth is projected for firms which occupy such space. Based on trends in the U.S. economy, Boston's services, finance, and communications firms will grow rapidly in the coming decade, and their expansion is expected to generate at least seventy-five percent of new employment downtown. Office employment is projected to reach 209,000 jobs by 1992, an increase of 34,000 jobs from the 1982 level.

Second, Boston is an attractive location for the office industries. As the hub of a metropolitan area, the city offers retail and cultural attractions, and transportation facilities suited to office businesses. In addition, Boston serves as a national center for education, medicine, and other professional services. These factors, in concert with on-going public and private investments in Central Boston, all have contributed to the interest in Boston expressed by potential renters and builders.

Third, space requirements have changed. Locally and nationally the amount of space occupied per employee has increased. In Boston the average gross square footage per employee ratio rose from 209 in 1966, to 240 in 1982. If this trend continues, it will generate some of the future demand for office buildings.



However, new construction lagged behind the growth in office employment between 1975 and 1982. As office vacancy rates declined, local developers turned to rehabilitation to quickly bring additional office space on line. Since 1975, 4.6 million square feet of office space has been upgraded. At present, 1.4 million square feet of office space is undergoing renovation, and 6.4 million square feet of office space is under construction or scheduled for completion over the next three years.

Indicative of the current strong demand for additional office space are the low vacancy rates and high office space absorption rates in Boston. Currently Boston has one of the lowest vacancy rates of any major U.S. city: vacancies downtown are 1.5 percent for new and newly renovated space and 5.1 percent for all office space. The annual absorption rate, an indicator of how quickly new space is being leased, has averaged over 900,000 square feet during the past five years.

Boston's office sector is expected to continue to expand throughout the next decade, and it is estimated that businesses will need between ten and thirteen million square feet of additional office space by 1992. Buildings now under construction will meet part of this demand, but an additional four to seven million square feet will be required.

DEVELOPMENT ISSUES

The projections for continued growth in the office sector will have a positive effect on other sectors of Central Boston's economy and on the city as a whole. Business visitors are a major component of the city's expanding hotel sector and likewise, office workers are a major component of Central Boston's captive retail market. Their increasing numbers in recent years has helped to reverse the decline in retail sales and to fill new hotel rooms.

While office sector growth has bolstered other local businesses and helped to generate new jobs, it has also benefited the City's fiscal profile. Revenues derived from office buildings contribute substantially to the local property tax base and have helped to reduce the property tax for residential owners.

The location of new office projects can support the City's efforts to redevelop underutilized areas, such as portions of Washington Street, and North and South Stations. With the reductions in Federal funds and the budget limitations imposed by Proposition 2½, the City will rely even more on office developers to provide public improvements formerly undertaken by the City to revitalize such areas.

Recent initiatives from the City have led to the contribution of housing funds from downtown commercial projects. The Arlington-Hadassah development will contribute a minimum payment of 600,000 dollars, and the Rowes/Foster Wharves project will provide 500,000 dollars annually as part of its lease agreement with Boston. The funds will be used to generate housing opportunities for low and moderate income households.

Despite the current and potential benefits of the office boom, the growth is not without its adverse impacts. Some of these are outlined in the Environmental Quality and Design sections of this report and include excessive levels of wind and noise, shadows cast by tall buildings, and degradation of air and water quality, as well as aesthetic issues of urban form.

As well, because the market for office space is strong, office developers can frequently pay more than existing or other potential users of downtown property. This situation can result in pressure to demolish older buildings, sometimes threatening the city's architectural heritage. There is pressure on manufacturers to relocate, which threatens peoples' jobs and the diversity of the local economy. There is pressure as well on the residential stock, occasionally through demolition but primarily through the inability for residential developers to compete for space.

The amount, timing, form, and location of office development requires careful management by the City. The use of development guidelines will assist the City to maintain the current stability of the office market and will maximize the potential benefits of office development for Boston.





Retail Development

The city historically has served as a major regional retail center, attracting people who live and work in Boston, as well as those from the suburbs. Today Central Boston remains the foremost shopping area in the region. With approximately 5.8 million square feet of gross leasable retail area (including that occupied by retail stores, restaurants, and cinemas), Central Boston's retail space is the largest in the region and twice the size of the largest suburban grouping — the combination of North Shore Shopping Center and Liberty Tree Mall. Estimated retail sales of comparison goods — apparel, general merchandise, furniture and home furnishings, and miscellaneous goods — reached 5.8 billion dollars in 1982.

Retail activity in Boston is expected to grow even stronger. "The Downtown Crossing Economic Strategy Plan", recently released by the BRA, forecasts the potential for sixty percent increase in retail sales in that shopping district by 1990. Opening in 1984, Lafayette Place and Copley Place will add retail space in Downtown Crossing and Back Bay, respectively. Neighboring developments, such as the State Transportation Building and its retail component — Cityplace — are likely to further enhance the city's retail market.

The expansion of retail space downtown, the increase in retail sales, and the nearly ten percent growth in retail employment represent a marked improvement over the decline in retail activity between 1948 and 1977. In that period, Central Boston's regional share of retail sales dropped from twenty percent to 6.5 percent. As the suburban population increased, the city's retail market shrunk in terms of relative affluence and size: median family income in the region grew by nearly ninety percent, that of Boston's residents increased by less than forty percent. The shift of population to the suburbs and

competition from suburban shopping centers seriously eroded retail sales for stores concentrated around Washington Street, the city's primary retail area. Since well before World War II, the mix of products and merchandising techniques were firmly established to meet the needs of the area's traditional middle-income shoppers. For stores which could not quickly adapt their retail strategies to attract new shoppers, sales declined. Some major department stores closed their doors, as did many smaller shops.

In contrast to the Washington Street retail area, Back Bay — Boston's second largest shopping district — had great success in attracting additional shoppers between 1948 and 1977. Back Bay had always offered a more cosmopolitan variety of merchandise — high fashion apparel, art, and fine food — which suited the needs of the city's affluent residents and the specialized needs of some suburban shoppers. The Prudential Center, developed in 1965, substantially increased retailing in Back Bay.

Recent trends have improved retail activity in Central Boston. The rate of suburban economic and population growth, as well as suburban retail sales, has stabilized in the past decade. Employment growth in Boston's commercial and institutional sectors, especially in the office industry; an increase in the number of downtown residents and higher per capita income of those residents; and new marketing strategies have all contributed to the current prosperity of Boston's retail centers.

Faneuil Hall Marketplace, the city's newest and third largest retail center, symbolizes the renewal of retail activity in Boston. Developed between 1976 and 1978, the Marketplace established the unique attraction of festival market shopping, now duplicated in other parts of the U.S. The renewal of the historic but decaying Faneuil Hall environs illustrates the role retail

activity can serve in revitalizing underutilized areas of the city and in expanding the local economy. The inclusion of pedestrian malls, outdoor entertainment, and strict area-wide management were relatively new marketing strategies in Boston and, in only a few years, have helped Faneuil Hall Marketplace to become a major retail and tourist attraction. Estimated consumer-oriented retail sales (comparison goods, restaurants, and entertainment) amounted to eighty million dollars in 1982, well over three hundred dollars per square foot.

Improvements to the Washington Street retail district have helped to reverse its decline. In 1978, vehicular traffic was restricted along some streets to form a pedestrian mall. A new name, Downtown Crossing, and landscaping improvements, such as brick paving, lighting, benches, and an arcade, gave a special identity to the area. Several large stores re-oriented their merchandising techniques, and specialty shops moved into some vacant buildings. Both attract business from the growing number of downtown employees. Estimated 1982 consumer-oriented sales totaled 450 million dollars, over two hundred dollars per square foot. Nearly half the purchases were made by downtown employees. Today Downtown Crossing surpasses all other New England shopping centers in total square footage and retail sales.



In addition to the three major retail districts, other Central Boston retail clusters — Charles Street, the North End and Haymarket, the Waterfront, Chinatown and the Theater District — have distinct identities and draw customers from beyond the districts' immediate neighborhoods. Comparison, convenience, and service shops, and restaurants are scattered throughout the Financial District, serving the needs of office workers, and in other parts of Central Boston, where they accommodate residents of immediate neighborhoods. The 1982 estimated consumer-oriented retail sales for these areas combined, totaled two hundred million dollars.

DEVELOPMENT ISSUES

To capitalize on the potential benefits of retail growth and to help provide safe, convenient, and suitable shopping facilities for residents and visitors, the City will continue to implement existing development strategies and design new ones which could help to accomplish the goals noted below.

Development policies should aim, first, to increase retail activity in Central Boston. "The Downtown Crossing Economic Strategy Plan" is a step in that direction, providing adequate market information to attract new retail investors. Central Boston has an advantage over regional retail competitors because of its distinctive architectural, historic, and cultural attractions, but those attractions have not been sufficiently marketed to regional shoppers. Better promotion may help to increase retail activity from the regional market, as demonstrated by the success of Faneuil Hall Marketplace and Back Bay.

A second aim of retail development policy is to maintain and expand the variety of products and price ranges, as well as the distinctive characteristics of Downtown Crossing, Back Bay, and Faneuil Hall Marketplace. The Back Bay shopping district and Faneuil Hall Marketplace are both retail successes. It is important to ensure that the qualities which give them their special character are preserved. Large scale retail development that would broaden the market appeal and magnitude of these districts to a point at which it would dilute their special character should be discouraged.

Downtown Crossing requires special attention, since it is the one retail district that suffered from a long-term decline. Its enhancement is closely tied to goals for revitalizing adjoining underutilized areas — lower Washington Street and the adult entertainment zone. For these reasons, the implementation of "The Downtown Crossing Economic Strategy Plan" is especially important.



A third aim of retail development policy is to improve the vitality and attractiveness of some shopping districts so they will contribute to the physical, as well as economic, improvement of the city. Small-scale changes — landscaping, well-located benches, signage, outdoor cafes — can give a clear identity to an area and make it more habitable. The “Downtown Crossing Economic Strategy Plan” describes small-scale physical improvements that the City and merchants could implement in that part of Central Boston. Copley Square in Back Bay could be a hospitable, lively place for shoppers to relax or view outdoor entertainment, but it is not well-connected with the street, lacks trees and comfortable seating. A process is underway by the BRA to determine what design changes could make the square a more vital open space.

In addition to small-scale changes, substantial retail projects can improve the design of key areas of the city, especially when retail is included in development schemes for other commercial sectors. When planning new development of some magnitude, it is important to locate retail establishments in a way that will reinforce activity along streets.

A fourth aim is to improve the accessibility of retail areas. When shops are safely and easily accessible and provide a variety of goods in a range of prices, the retail sector can effectively meet the needs of shoppers. Some areas are currently perceived as unsafe. Major problems facing Downtown Crossing are the close proximity of the adult entertainment district and underutilized areas of lower Washington Street, and the lack of nighttime activity within Downtown Crossing itself.

Accessibility is a key factor in attracting shoppers and in facilitating their activities. It could be improved for all three major districts. Downtown shoppers depend on mass transit, and over sixty-five percent of frequent MBTA riders shop there. However, those who do not use public transit are less likely to shop downtown (only twenty-six percent of non-riders shop there). To increase ridership and to improve the trip for current riders, an important component of development policy would aim to incorporate new transit stations within planned development projects and upgrade existing ones. To attract auto-

oriented shoppers, development policy should promote better vehicular access without unduly burdening the circulation system and provide safe, convenient parking where it is most needed. Lafayette Place Garage, with approximately eight hundred spaces reserved for shoppers, is an example of this.

Guiding retail growth is important to the city physically, economically, and socially. As evidenced by Faneuil Hall Marketplace and Downtown Crossing, retail improvements can upgrade the appearance and utility of open spaces and streets in commercial districts, spurring area revitalization. Retail growth can draw more business from the regional market, provide additional jobs and tax revenue, and stimulate growth in other commercial sectors. When shops are easily accessible and provide a variety of goods in a range of prices, the retail sector can help to meet the needs of residents, workers, and visitors.





Manufacturing

Although Boston was known as a regional center for mercantile trade, manufacturing has always played a prominent role in Boston's economy. Industrial employment accounted for nearly thirty percent of the jobs in Boston in 1948, a greater share than that of any other sector.

Today manufacturing continues to perform an important role in the city. Manufacturing industries provide jobs for ten percent of the labor force, often in the proximity of employees' homes where the presence of manufacturing firms contribute to the health of the neighborhoods. At a time when employment is growing in other sectors, the continued presence of industry in the city affords some variety in occupations available to residents and helps to maintain a diversified economy. As well, by exporting products regionally and nationally, industrial activity draws new dollars into Boston.

Between 1948 and 1975, Boston was in danger of losing its industrial base. During that period, jobs were lost as part of regional reduction in manufacturing, which was exacerbated locally by the closure of the naval base and a slowdown in port activity. Some traditional industries closed, some moved south or to less expensive land in the suburbs. Others remained in Boston but by employing less labor intensive methods of production, they have decreased their workforce.

Adjustments within the manufacturing sector and actions taken by the City have helped to stabilize the industrial employment level in recent years. Maintaining its current stability is an important component of development strategies for Central Boston, where over half the city's manufacturers and over half the manufacturing jobs are located. To assist in retaining Central Boston's manufacturing base, it is useful to understand the changing composition of manufacturing in Boston, the essential characteristics of industrial firms, and the issues that confront manufacturers, their employees, and the City as downtown development takes place in the coming decade.

Adjustments in the composition of manufacturing in Boston have helped its performance. While traditional industries — apparel, and leather, printing and publishing, fabricated metals, and non-electrical machinery — remain the five largest in the city and account for approximately seventy percent of the manufacturing employment, the new high growth industries have expanded. These include firms producing instruments, electrical equipment, transportation equipment, chemical products, and rubber and plastics.

In the 1980s, durable goods manufacture is projected to grow most substantially, especially in those firms which produce electrical equipment, non-electrical machinery, instruments, and transportation equipment. This projection reflects the regional and national growth in the manufacture of high technology goods. Employment in the printing and publishing industry is expected to increase moderately, but some other traditional industries, such as food products and apparel, are likely to experience some employment losses.



In Boston large firms and existing manufacturers are expected to have the most significant impact on the future of industrial activity; this runs counter to trends observed in some other cities. The city's nearly one thousand established firms reported most of the recent employment gains. Firms with over one hundred employees account for sixty percent of the city's manufacturing jobs and while these large firms are small in number, they dominate in the manufacture of primary metals, electrical equipment, and instruments. The latter two are among the city's high growth manufacturing sectors. Expansions and contractions of these large firms are major factors in the strength of Boston's manufacturing base. Nonetheless, small firms predominate in Boston. Over eighty percent of the manufacturers in Boston employ fewer than fifty workers and their presence should help to maintain the city's neighborhood economic base.



In Central Boston manufacturers are concentrated in ports of Downtown and near Fort Point Channel, but also in parts of the Back Bay, Fenway, and South End. Downtown, firms tend to cluster in lower rent areas, such as Chinatown and the Leather Districts, and remaining there is of particular importance to some of them. Printers and publishers choose to be near major customers. Apparel manufacturers rely on their proximity to workers from Chinatown; forty-four percent of the garment workers are employed there. In addition to firms from the traditional sector, some high-growth manufacturers are located Downtown. Approximately eighty-two percent of instruments sector employees work there. Downtown is losing its prominence as a manufacturing location, although development strategies can help to maintain a solid base of industry there, as noted below.



DEVELOPMENT ISSUES

To maintain its existing industrial base and foster the expansion of growing sectors, the City will continue addressing several important issues. One major issue facing manufacturing firms is the possibility of displacement from commercial and institutional expansion. Some high technology firms can afford to compete for prime locations. However, faced with competition for space from commercial and institutional developers, some traditional firms may close or migrate. The plight of Chinatown's garment industry is illustrative: approximately 185 apparel manufacturers are located in Chinatown, and traditionally they have drawn their work force from residents of the area. Institutional expansion caused thirty-five firms, employing two thousand workers, to seek relocation assistance from Boston's Economic Development and Industrial Corporation (EDIC/Boston). The agency has helped those firms with immediate needs for space to relocate within the city, and EDIC is now developing alternate industrial space for the garment companies and other manufacturers by renovating the underutilized Boston Army Base located in South Boston, near Chinatown.



The former Army Base contains 1.4 million square feet of net leasable space and is available to industries under pressure to relocate because of rising rents or expansion needs. Companies now located around Fort Point Channel and North Station and which are jeopardized by downtown development, should find the Base a suitable facility in which to relocate. In order to encourage expansion of other sectors without jeopardizing the future of manufacturing, other likely sites in the city for industrial activity will be promoted. Opportunities currently available include the industrially-zoned areas of South Boston and Roxbury.

Although one of the most important facets of the City's industrial policy has been to develop areas of Boston which offer relocation and expansion opportunities, EDIC/Boston has also implemented other strategies to address this issue. They include marketing programs, the provision of real estate listings, and financial assistance. The City has also affirmed its commitment to the manufacturing sector by maintaining industrial zones in Central Boston in the face of pressure from the development of other uses. As

development proposals are reviewed in the future, that commitment will be maintained. The City will continue to assist in retention and relocation efforts, looking for solutions in a city-wide context.

Equally as important as location are the types of jobs created and kinds of skill required by the changing industry. Skills required for manufacturing jobs have changed as employment in traditional sectors has declined. Modernization within traditional sectors, and growth in high technology sectors and in the service industries require different sets of skills. To adjust, workers require training. Budget cuts in publicly-supported training programs have curtailed some re-education efforts, but the City, in cooperation with the Private Industry Council, has instituted new training programs. EDIC/Boston's Technical Center offers industrial training programs tailored to needs of specific companies. Companies moving into the City's three industrial parks must agree to target fifty percent of their permanent jobs for Boston residents, to give residents priority in their in-house training programs, and to give priority placement to graduates of City training programs.



As development takes place in Central Boston, the City will continue to implement development strategies to maintain its industrial base, to develop suitable locations for manufacturing, to assist in skills readjustment, and to promote employment opportunities for Boston residents.



Visitor-Related Facilities

Boston is a great city to visit, judging from the number of new hotel rooms constructed in recent years. During 1981 and 1982, four new hotels and one addition were completed, increasing the stock of hotel rooms by over thirteen hundred rooms. By late 1982, construction of four more hotels, with a total of over twenty-seven hundred rooms, was underway. This new construction represents the recent growth of Boston's visitor-related sectors — its convention, tourist, and the hotel industries — and the prospects for growth of these and other commercial and institutional sectors for the coming decade.

Because of the impact that visitor-related sectors have on other sectors of the local economy and on employment in Boston, it is important to understand how current conditions, trends, and events will affect the growth prospects of the city's convention, tourist, and hotel sectors.

CONVENTIONS AND GATE SHOWS

Boston's success in attracting national and regional meetings, as well as public events, depends primarily on the availability and quality of its gate show, convention, and hotel facilities. Now and for the next few years, the city is better equipped to draw gate shows than conventions. Inadequate meeting room facilities and the limited price range for accommodations hamper efforts to expand the convention market here. As a result, the City and, to an even greater extent, the Commonwealth are losing potential increases in business and tax revenues.

Currently there are two major gate show and convention facilities in the city. Hynes Auditorium, a publicly-owned convention center, offers meeting, exhibition, and auditorium space. The Hynes can accommodate gate shows but because these regional attractions generate high volumes of traffic,

congesting streets in adjacent neighborhoods, the Hynes limits its gate shows to twenty-two annually.

The Hynes Auditorium attracts approximately thirty conventions annually, five percent of the large conventions held nationwide. Currently, few cities draw more than fifty conventions per year, but the national convention market is expected to grow by about two percent annually. If the Hynes Auditorium were expanded, as proposed by the City, Boston could attract ten percent of the national convention market, doubling the number of conventions held in the city by 1990.

In 1981, the City of Boston (which then owned and operated the Hynes Auditorium) explored the possibility of enlarging the facility and with the assistance of consultants and industry representatives, developed a program and design concept for its expansion. The Commonwealth, which had provided financial support for the City's efforts, purchased the Auditorium in 1982 and established the Massachusetts Convention Center Authority. The Authority is now reviewing the City's plans for expanding the convention facility.

Bayside Exposition Center, a new, privately-owned gate show facility, has extensive exhibition space and is well-sited for handling traffic. It has minimal facilities for meetings and large assemblies that characterize conventions.

A third major facility, Boscom, will be opening soon. Massport has leased Commonwealth Pier, formerly a gate show facility, to a private developer to create a high-technology trade mart. Reconstruction of the pier will provide exhibit sales space, permanent showrooms, and meeting rooms. Although Boscom will serve primarily as a center for marketing high-technology products to trade representatives, space will be available for general trade, gate shows, conventions.

TOURISM

Between 1970 and 1983, tourism in Boston grew at an annual rate of 4.8 percent and in 1983, over five million tourists visited the city. Tourism is expected to grow by 3.3 percent annually and according to this projection, over seven million tourists will visit Boston in 1992.

Past and projected growth stems in part from revitalization efforts in Boston. Prior to the country's Bicentennial Celebration, many of the city's more than three hundred historic and cultural attractions were improved and remain in good condition today. The redevelopment of Faneuil Hall into a marketplace, improvements to Downtown Crossing, and the continued growth of retail activity in Back Bay have increased the attractiveness of shopping in the city. Projects recently completed or under construction, such as the State Transportation Building and its retail center (Cityplace), and The Four Seasons hotel and condominium complex, will help revitalize the Theater District. Renovations to several theaters — the Shubert and the Wang Center for the Performing Arts (both completed), and the Saxon (planned) — will improve both the quality of performance facilities and the image of the district.

However, the growth of tourism in Boston is likely to be constrained by the city's limited supply of moderately-priced hotel rooms. This is likely to dampen the potential growth of tourism in Boston from the six percent expected nationwide to 3.3 percent.

HOTELS

With the substantial amount of hotel development underway in Boston, the number of hotel rooms will increase from 7,925 in 1983 to 11,000 in 1985. The renovation of over sixteen hundred rooms between 1978 and 1983 has improved the quality of Boston's hotels, as will the renovation of another sixteen hundred rooms

slated for improvement by 1985. With employment growth in the office industry, the expansion of the Hynes Auditorium, and a more aggressive marketing campaign for visitor-related facilities, the number of rooms required could grow from approximately eight thousand at the beginning of 1983 to slightly over fifteen thousand in 1992.

However, with the delays in expanding the convention facilities and the limited funding for promoting visitor-related facilities in Boston, some concern exists about the prospects for the hotel industry in the next five years.

Some hotels were built in anticipation of the expansion of the Hynes Auditorium. Uncertainties surrounding the timing of the expansion and its possible closing during reconstruction will reduce the number of conventions held in Boston by 1988, given the long lead time for booking conventions. This would lead to about a five percent decline in occupancy rates from the 1982 level of nearly seventy percent, a satisfactory norm for the industry.

An equally important concern is the inadequate supply of moderately-priced hotel rooms. The hotels planned and under construction will add a disproportionate share of expensive accommodations to the hotel stock in Boston, deterring visitors of modest means. To increase tourism, attract conventions, and make the city more affordable for all visitors requires that accommodations be available in a balanced range of prices.

As visitor-related development projects are proposed, it will remain important to consider the timing of hotel development with respect to the city's overall economic growth and that of convention and arena facilities; to increase the supply of moderately-priced accommodations; and to ensure the employment of Boston residents within the industry.

Institutional Development

Boston's image nationally and globally is closely tied to its pre-eminence in education and medicine. Within the city, these fields have increased the local economy and have produced jobs for Bostonians. Residents of the city fill forty percent of the institutional jobs, five percent more than they capture of the city's total employment. Medical and educational institutions are major employers in Boston; over ten percent of employees in the city work in colleges and medical facilities. Institutions have also helped to expand the economy of the metropolitan area and have been integral to the regional growth in high technology and bio-medicine.

While other sectors, such as the office industries, account for a greater share of jobs, single institutions provide an exceptionally large number of jobs. In Central Boston over thirty thousand people are employed by major medical and educational institutions, including Massachusetts General Hospital, Brigham and Women's Hospital, New England Medical Center, and Northeastern University.

The physical renovation and expansion which has accompanied employment growth in some institutions has been impressive. Between 1975 and 1983, medical institutions in Central Boston added nearly three million square feet of space. Much of the expansion occurred in the Fenway which has the largest share of institutions of any area in the city and includes the Longwood Medical Area, with its eleven hospitals and Harvard Schools of Medicine. Sizeable developments elsewhere in Central Boston were undertaken by Tufts Medical Schools and New England Medical Center, located in Chinatown, and by Massachusetts General Hospital, located near North Station.

Some of the smaller development projects have helped to conserve Boston's architectural heritage. For example, as Massachusetts General Hospital recently cleared a site for expansion, the institution relocated its old, distinctive, physicians' residence to a prominent location on Cambridge Street, rather than demolish it. Other institutions, such as the Children's Museum and the Institute for Contemporary Art, have created new uses for obsolescent buildings. The Museum moved from Jamaica Pond to buildings it renovated on the waterfront, and the Institute moved into an old firehouse it redesigned on Boylston Street.

In the coming decade the employment level in medical institutions is expected to grow by nearly thirty percent. As the demand for health care increases, employment is projected to increase by five thousand jobs by 1992. A greater emphasis on research, the need for additional medical office space, and institutional consolidation (such as that of Brigham and Women's Hospital) have generated many development projects in the recent past and are likely to continue to do so in the coming decade. The Commonwealth's health care cost containment legislation could dampen institutional development plans in the 1980s but given the strength of health care providers and current national growth trends in medicine, legislation is not likely to significantly affect long-term growth.

Institutions of higher education, which expanded substantially to accommodate the post-World War II baby boom, will not increase their employment levels in the 1980s. Enrollment at Central Boston's larger colleges might decline due to fewer high school graduates and the low national birth rate. However, some schools are developing or expanding vocational and adult education curricula in an attempt to counter declining enrollments.

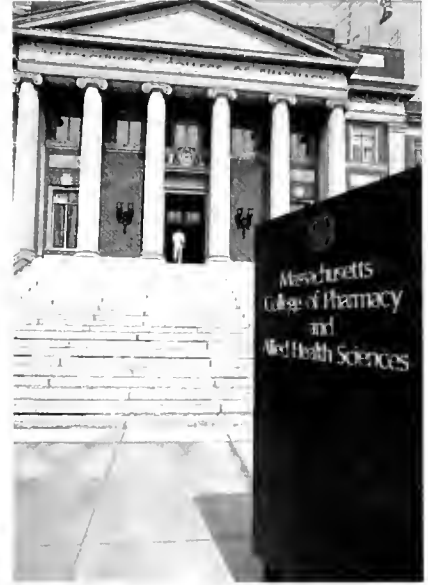
DEVELOPMENT ISSUES

Although institutions play a key role in the city's employment growth and physical development, not all of this growth has been beneficial to Boston. Institutional expansion in some of Central Boston's neighborhoods, such as the Fenway, Chinatown, the South End, and Back Bay, has reduced the city's housing supply and has led to residential displacement.

Institutions are for the most part non-profit and are not obligated to pay real estate taxes to the City. In Boston over sixty percent of property is tax-exempt. Now that the City's ability to generate additional revenues is constrained by Proposition 2½, it becomes especially important to carefully review development proposals which would increase the percentage of tax-exempt land.

Though not all institutional growth has generated direct and severe impacts, it also not always brought the benefits it might. Too often, institutional planning has been completed in a piece-meal fashion and has missed opportunities to improve both the institutional complex and adjacent neighborhoods.

Plans allowing a mix of uses could promote vitality in somewhat uniform institutional areas, serve the needs of people living and working there, and help to improve public safety. This prospect is especially important where major institutional complexes, such as New England Medical Center, Massachusetts General Hospital, Northeastern University, and the Longwood Medical Area, are located near key revitalization areas in Central Boston, such as Chinatown, North Station, and the Fenway.



Planning coordinated among the institutions themselves could lead to more substantial benefits for individual institutions and minimize their need to acquire additional properties for expansion. This coordination would be beneficial because as universities and hospitals compete for students and funding, each tends to build the largest and most up-to-date facilities with little thought to collaborative use among institutions. Duplication of facilities often results in the unnecessary use of land and capital. Institutions have developed some projects jointly, such as the Medical Area Total Energy Plant and Medical Area Service Corporation's activities for Longwood's institutions, but few research and medical office buildings are shared.

To maximize the benefits and minimize undesirable impacts of institutional growth, Boston employs several policy tools: in-lieu-of tax arrangements, neighborhood and zoning review, and institutional master plan requirements. Through these, the City requests institutions to help support municipal services; to provide housing and parking for students; to improve the appearance of their facilities and open

space; to provide programs and facilities beneficial to neighbors; and to avoid expansion into residential areas.

One policy tool, in-lieu-of tax arrangements, allows the City to recover some of its lost real estate revenue in the form of direct payments and/or community services. Typically, applications for the City's approval of institutional development plans have triggered negotiations for new in-lieu-of tax arrangements. Existing arrangements are often updated when institutions propose additional expansion projects and are revised to reflect the increased demand for municipal services that new facilities will create.

A second policy tool, neighborhood and zoning review, can be used to control the impacts of institutional expansion. In the Fenway, institutional zoning for the East Fens, West Fens, and St. Botolph areas has led to additional public input for institutional proposals. Most institutional uses in the zone require approval of the City's Zoning Board of Appeals as conditional uses, and any changes are subject to neighborhood and City review.

A third tool used to guide institutional growth is the City's policy requiring that institutional master plans accompany development plans. In its recent review of New England Medical Center's proposed expansion, the City withheld its approval, pending submission of an acceptable master plan which addressed the residential needs of Chinatown.

In summary, the growth of medicine and education is an important component of Boston's economy, but institutional expansion is not without attendant problems for the City's tax base and neighborhoods. Development policies can minimize the negative effects of institutional growth and in fact have already done so. Development policies can also help to elicit substantial benefits from institutional growth, but this will require more coordination amongst the institutions, the City, and its neighborhoods, and it will depend on the quality of institutional planning itself.



Residential Development

The employment growth forecasted for Boston's commercial and institutional sectors promises additional job opportunities for the city's present and future labor force. Meeting that future demand and alleviating the current shortage of decent, affordable housing in Boston presents challenges which the City will address in formulating development strategies and policies.

Changes in demographic trends, such as the increase in the number of smaller households; rising costs of development; and reduction in Federal housing subsidies have constrained the residential market and have generated the housing issues — affordability, a restricted supply of decent housing, and residential displacement — confronting the City and its residents today.

Boston's housing has changed significantly over the past two decades. The changes are reflected not in the number of units but in the composition and location of the housing supply, forms of tenure, and characteristics and needs of residents.

The total number of units has increased only slightly, growing from 238,800 in 1960 to 241,400 in 1980. Though the supply of housing shows little net growth, it has fluctuated over the past twenty years. Between 1960 and 1970, there was a net loss of over six thousand units. In the following decade, the net addition of nearly nine thousand units more than restored the previously diminished supply.

Abandonment and demolition removed a number of one-to-four family residences, primarily rental stock. The supply of such housing declined by over ten percent between 1960 and 1982. Owner-occupancy has increased, but changes in tenure, rather than new construction, accounted for this growth. The institution of condominiums has fostered home ownership but has not significantly expanded the housing stock. Between 1970 and 1980, only twenty percent of the condominiums established were newly constructed. The majority were established through changes in the existing housing mix: by mid-1980, 1,780 luxury apartments were converted to an equivalent number of condominiums; 1,913 moderately priced rental units were redesigned to create 1,677 condominiums; and 722 rooming house units were combined into 247 condominiums.

As owner-occupancy increased, the supply of market-rate rental units diminished. In the 1970s, there was a net decrease of two thousand units. Subsidized housing assumed a greater share of the housing inventory, growing by about eighteen thousand units in the 1970s. Costs of renovation, new construction, and financing rose and created disincentives for residential development. The assistance of Federal Section 8 and State-financed programs countered changing economic forces to some extent and attracted residential developers to the subsidized market. As a result, the number of assisted units in the city rose to forty-two thousand in 1980. Even with the additional units, demand for subsidized housing outpaced the supply. City-wide, rents kept pace with inflation, increasing by over ninety-six percent between 1970 and 1980, and the price of homes climbed by over eighty-four percent. In the same period, the vacancy rate for available, habitable units dropped from six percent to less than four percent.

Demographic characteristics of residents have changed, as have their housing needs. Though Boston's population declined by twelve percent between 1970 and 1980, the number of households remained constant. However, the number of families declined and were replaced by substantial increases in the number of small, one-to-two person households. Changes in household size, reflecting the lifestyle preferences of the post-war baby boom population, have produced much of the current demand for homeownership.

Though the net population declined, the percentage of minority and female-headed households increased. Housing patterns of these groups reflect their generally low incomes. Homeownership is low; minority and female-headed households need additional subsidized housing and family-sized units.

Viewed in a city-wide context, housing in the study area provides an important source of revenue and supplies a major share of particular housing types. Central Boston's housing inventory includes much of the city's rental stock — about half of its apartments and an equivalent supply of mixed residential/commercial property. The area also supports approximately thirteen percent of the single-family property in the city (this count includes units owned as condominiums.)

The housing market in Central Boston has reflected many city-wide trends of the past decade, such as the growth of condominium and subsidized housing, higher property values and rents, and smaller household size. But trends affecting Central Boston's market have departed from other general trends. Housing stock increased by approximately seven thousand units while the number of units city-wide remained constant. The number of people living in Central Boston grew by five percent at a time when the city's total population declined.

A composite of housing in Boston, or even in Central Boston, shows overall trends but cannot provide an adequate picture of housing issues confronting sub-areas within the city. Characteristics and needs of residents, composition of the housing inventory, and the potential for residential development vary amongst the city's distinct neighborhoods. The following section outlines some similarities and differences of Central Boston's neighborhoods and describes housing trends and issues that residents face.

Back Bay and the Fenway supply a large proportion of Central Boston's housing, much of it in rental units. Though the number of units increased slightly between 1970 and 1980, the supply of market rate rental units has dropped. The number of subsidized units has increased. In 1970, apartments comprised ninety percent of the two neighborhoods' housing stock but by 1985, the percentage is expected to fall to about sixty percent.

Back Bay's central location, rising market values, and the character of the housing stock all encourage condominium development. Over two thousand rental units were converted between 1969 and 1979. While the rate has diminished somewhat, condominium conversion still continues. As rental options are reduced, long-term residents are displaced.

In contrast, the Fenway houses a large student and elderly population which is generally less affluent than that of Back Bay. The real estate market and overall neighborhood stability of the Fenway suffered during the 1960s due to arson, real estate speculation, housing abandonment, and institutional expansion. With the infusion of large housing subsidies in the 1970s, the development of some luxury apartments and condominiums, and the increased activity of neighborhood groups, the area is slowly becoming more stable. However, the potential displacement of the low-income and elderly residents, reductions in Federal subsidies, and high housing costs will be critical concerns throughout the next decade.

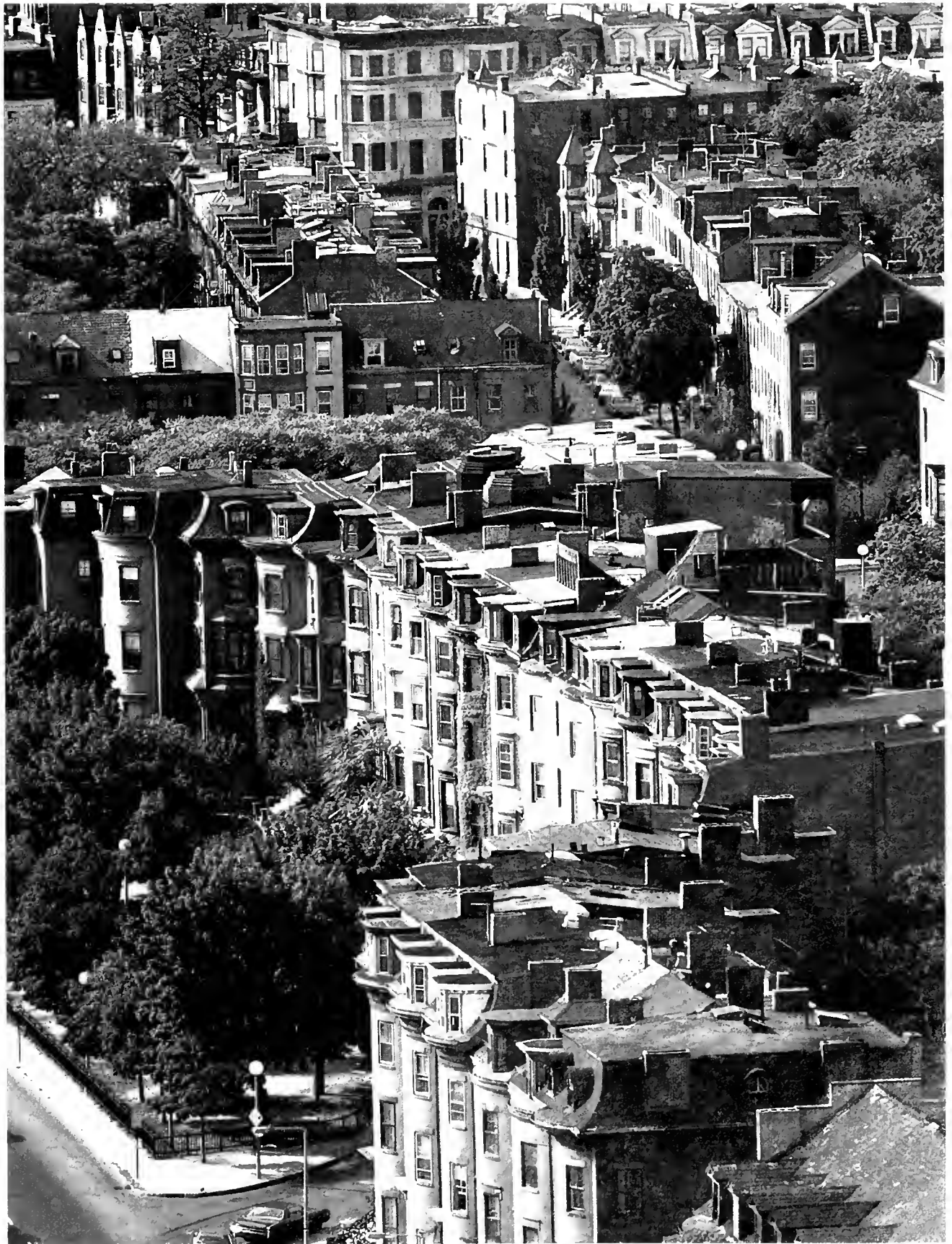
Beacon Hill and the West End are neighborhoods of Boston's affluent residents, and property values are higher than in many residential areas. The supply of housing has increased slightly, especially in the West End, as has the population. Condominium conversion, which occurred at a rapid pace on Beacon Hill in the 1970s, continues with the recently announced conversions of River House, Bellevue Hotel, and Tremont on the Common. As in Back Bay, displacement of the elderly population and housing affordability are issues of concern.

The North End, traditionally a tightly knit, Italian-American community, has become attractive to newcomers due to the neighborhood's proximity to Downtown, Faneuil Hall Marketplace, and the adjacent, revitalized Waterfront. Demographic characteristics of the area's residents are changing dramatically. The percentage of households that are families living in the North End and Waterfront decreased from sixty-four percent in 1970 to thirty-eight percent in 1980, and the number of single-person households increased. Half the residents in the two neighborhoods now live alone. Housing development along the waterfront ac-



counts for much of the change; underutilized warehouses and wharf space have been converted to luxury rental units and condominiums. Demand for housing is expected to remain strong and although the number of subsidized housing units increased by four hundred between 1970 and 1980, housing affordability will continue to be a major concern.

In the South End, the housing supply increased by over twenty-five percent between 1970 and 1980. Population in the area rose by about twenty percent, and the incidence of owner-occupancy is expected to do the same over the next decade. However, new residents are more affluent than most long-term residents living in the area. Condominium conversion and owner-occupancy of rental units have contributed to the loss of apartments and rooming houses, creating problems of displacement and affordability. The addition of thirty-three thousand units of subsidized housing partially alleviated the problem, but conflicts over what income groups will control residential development on vacant land continue to occur in the South End.



Summary Characteristics of Central Boston by Neighborhood 1970-1980

Census Tract District	Population	Percent Change in Population 1970-1980	Percent Change in Households 1970-1980	Percent Black	Percent Aged 65 and Over	Percent of Units Owner-Occupied	Percent Change in Owner Occupancy 1970-1980	Average Household Size	Percent Change in Average Household Size 1970-1980	Families as Percent of Households	Percent Change in Families as Percent of Households
Back Bay-Fenway	49,517	-4.6	-2	9.5	7.3	9.7	225.1	1.5	2.0	18.2	-21.4
Beacon Hill-West End	14,894	9.5	4.7	3.0	11.1	13.8	82.1	1.6	8.9	24.7	-6.4
Waterfront-North End	11,639	5.1	34.1	1.5	14.2	15.1	51.3	1.8	-22.8	38.5	-38.0
Charlestown	13,364	-13.0	9.0	.2	12.4	32.1	7.7	2.5	-14.0	58.9	-19.3
South End	29,611	20.8	30.3	26.6	8.2	12.7	46.3	2.0	12.6	36.8	-9.6
Central Boston Total	119,025	-2.2	11.0	11.1	10.1	15.9	63.6	1.8	-8.3	30.0	-16.3

Source: 1980 Census of Population and Housing. (By Census Tract District).



Charlestown, the smallest of Central Boston's neighborhoods, is populated primarily by moderate income people. Sixty percent of the housing there is in one-to-four family, owner-occupied buildings. With the addition of several hundred units in the 1970s, thirty percent of the housing stock is now subsidized. Family size is declining in Charlestown, as elsewhere in the city, but at a higher rate than in some neighborhoods. The average age of residents has increased, and the size of the population has fallen by eighteen percent. Although there was a loss of homeownership during the early and mid-1970s, middle and upper income professionals began to migrate to Charlestown during the late 1970s. The Navy Yard development will add one thousand market rate rental and condominium units to the neighborhood over the next five years and will inevitably affect the socio-economic mix of the Charlestown community. As elsewhere, housing affordability will be a main concern in Charlestown in the coming decade.

Boston's Downtown encompasses several distinct subsections, including the Theater, Leather, and Financial Districts; Chinatown and South Cove. Consonant with the image of a downtown, most of the land uses found in the area are retail, manufacturing, or office related. Physical deterioration, building obsolescence, and changing market forces are now creating opportunities for new residential uses in this predominantly business district. In particular, the Leather and Theater Districts are areas where new residential development, achieved primarily through adaptive re-use of buildings, is already occurring and is likely to accelerate in the coming decade. As planned commercial projects materialize, the desirability of these areas for residential use will increase.

The stability of residential Chinatown is threatened by intense development pressures resulting from the construction of Lafayette Place, the renovation of the South Station area, the revitalization of the Leather District, and the Park Plaza area, and continuing expansion and development of Tufts University Medical Schools and New England Medical Center. Through re-use of vacant manufacturing buildings, the decline of the garment industry could afford new opportunities to accommodate Chinatown residents' critical need for housing units. As elsewhere, financial considerations are primary, and development projects will need public subsidies to make them affordable to the low and moderate income population.

The Chinese-American community extends beyond the borders of Chinatown. Many Chinese live in South Cove, and others are moving into housing on lower Washington Street and in the South End. South Cove is comprised of institutional and residential land uses primarily, with supportive residential services. Since 1970, approximately six hundred units of assisted housing have been constructed and are occupied primarily by Chinese-American residents. Only a few outstanding Urban Renewal parcels are available for development, and they could be put to residential use. New England Medical Center (NEMC), located in the South Cove area, is planning major capital development projects to expand and improve the quality of medical services. However, this expansion might reduce the housing stock available for the adjacent community. Any further development programs proposed by the institution should incorporate provisions for accommodating the residential needs of NEMC's neighbors.



DEVELOPMENT ISSUES

Over the past two decades, some trends have emerged which affect the housing market in Boston. While the overall number of housing units in Boston has increased slightly, changes in the population will increase the demand for residential units well beyond anticipated residential development and rehabilitation.

Condominiums may satisfy the growing demand for smaller homes, which has resulted from smaller household size and higher costs of real estate. However, condominium ownership may be beyond the financial reach of low and moderate income residents.

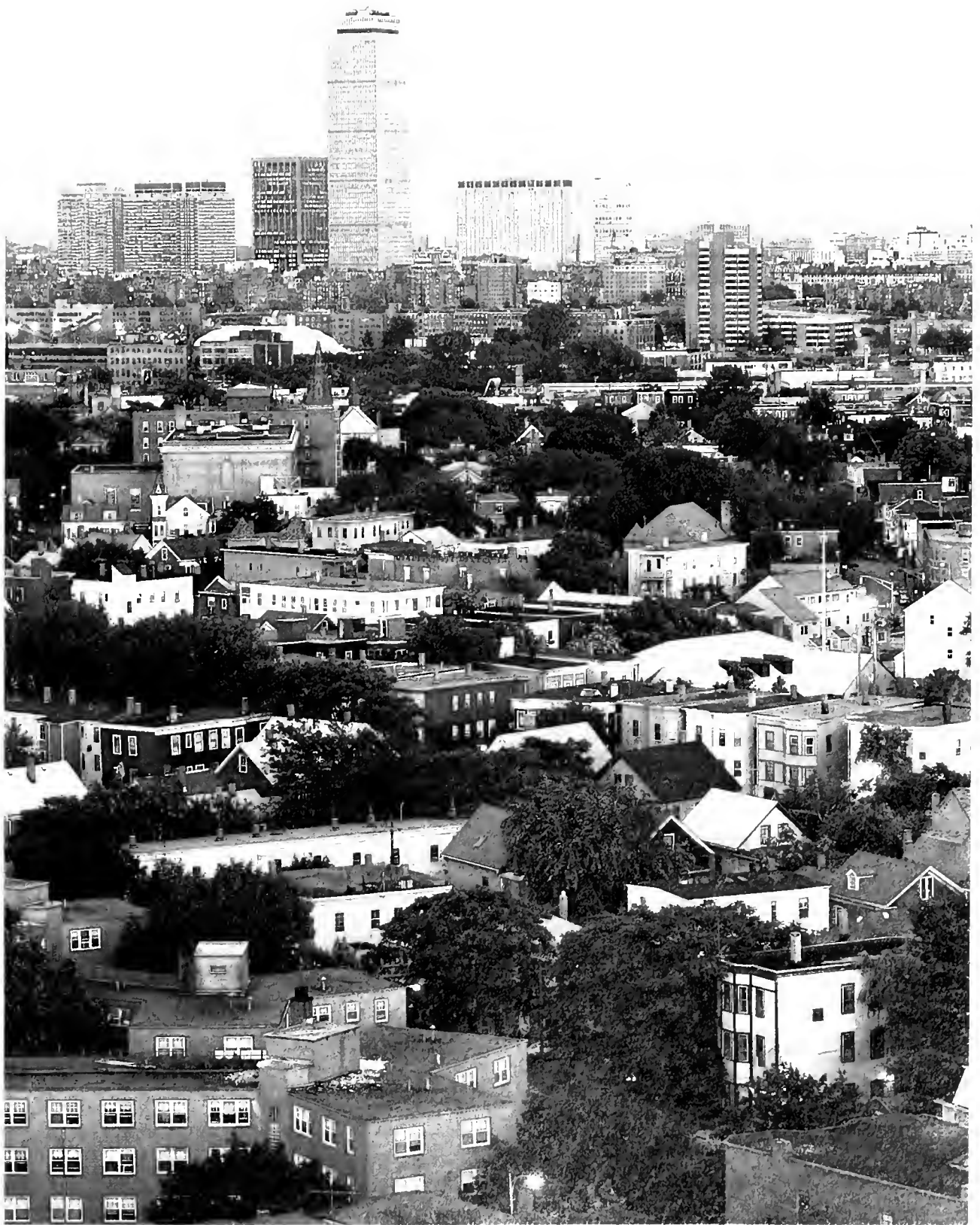
Though Central Boston is expected to retain its rental character, the ratio of owner-occupied to rental units is shifting. Owner-occupancy increased by over four percent between 1970 and 1980, growing by over six percent in the Back Bay/Fenway, and Beacon Hill/West End areas. The percentage of rental units declined by over four percent in the same period. In each neighborhood, rates at which the number of rental units declined closely approximate the rates at which owner-occupancy increased. During the next two decades, increases in the condominium supply will continue to alter the renter-to-owner housing mix in Central Boston.

Although change and residential mobility are natural phenomenon in neighborhoods; inflation, housing rehabilitation, and conversion of rental units to owner-occupied housing often force residents to move involuntarily. Many residents have few options when threatened with displacement. Low and moderate income households, especially those of the elderly, will be adversely affected if condominium conversions continue. Although displacement poses some hardship in any housing market, the low vacancy rate and high rent levels, which typify the current market, further exacerbate the housing problems of less affluent groups.

Some of the residential development projects now under construction will include subsidized and moderate income dwelling units, but current Federal housing policy will vastly reduce housing opportunities for low and moderate income residents during the next decade. In the absence of Federal subsidies, the private market will be less able and willing to provide new, affordable housing. In those parts of Central Boston where residential developers face stiff competition from commercial and institutional developers for limited real estate, prospects for affordable housing are especially bleak.

The City has begun to use commercial development as a means to provide housing for low and moderate income residents. The Boston Housing Development Trust is currently being established by the City to receive and distribute a share of the proceeds from the sale of municipal garages to support subsidized residential development. Similar contributions will be derived from development of the Arlington-Hadassah and Rows/Fosters Wharves projects.

The dynamics of development in Central Boston complicate attempts to maintain neighborhood stability and to improve housing options. Legitimate needs for jobs and revenue generated by commercial development, often conflict with equally legitimate needs for housing. The issues noted above affect the dynamics of Central Boston's housing market, as well as housing in all of Boston's neighborhoods. Because downtown development significantly influences the demand for housing throughout the city, this study is an appropriate means for addressing housing issues and for developing strategies and guidelines to alleviate some of the problems which confront present and potential residents of Boston.





Introduction

Growth and change in Central Boston in recent years has significantly reshaped the city's form. With the increase in office-related employment, the skyline which was once dominated by the State House dome, Custom House Tower, and church steeples, is now punctuated with tall buildings from the Financial District to the Fenway. Economic changes have altered some patterns of land use: housing, hotels, and parks, for instance, have replaced maritime trade along parts of the Waterfront. Modern building technologies and architectural design have generated forms, such as the John Hancock Tower, that were unimagined at the time the Faneuil Hall was constructed.

Similarly, development which will accompany social, economic, and technological change in the next ten years will alter the design of Central Boston. The potential impacts of that development raise controversial issues about the future design of Boston's downtown. Today, Central Boston's form is characterized by its modest scale, the rich and complex fabric of its districts, and its diverse architectural legacy. The debate over growth and change centers on the conservation of the city's present scale and design at a time when new technologies and the real estate market foster increasingly larger development proposals.

Addressing these design issues will require careful and imaginative planning and a full exploration of the many factors which shape the city. To initiate such a process, Central Boston is considered from three perspectives: from the bird's-eye-view, from the street level, and on the time continuum. Assessing Central Boston from these vantages in space and time includes exploring first, how it functions as a whole and how development could improve its organization and design; second, how the design of elements at a smaller scale — that of buildings, streets, and open spaces — influences people's experience of the city; and third, how development affects the architectural legacy of Central Boston.







Central Boston From The Bird's-Eye-View

The process of formulating an urban design strategy and guidelines for Central Boston begins with an assessment of Central Boston as a whole: its cityscape, its circulation networks, its distribution of land use, and its districts. Central Boston is considered from an overall perspective to determine how it now functions and how development might help to improve its organization and design.

CITYSCAPE OF CENTRAL BOSTON

The overall composition of Central Boston's natural features and man-made elements establish its cityscape, or urban geography, which has been extensively altered over time. Changes in the urban geography are likely to accompany development in the next ten years, affording opportunities for enhancing the cityscape and strengthening some of its important features. Understanding how the cityscape has changed in the past and how it might be improved are important steps in preparing design guidelines.

Central Boston's boundaries have expanded since the 1700s as land fill operations in Boston Inner Harbor and the Charles River Basin have tripled the city's land mass. Nonetheless, its location on a peninsula has limited Central Boston's expansion, creating both the vitality and congestion which accompany high density. Because of its compactness, Central Boston is traversable on foot, and a rich variety of buildings, public spaces, and activities are accessible within a relatively small area.

Within its boundaries, a number of components shape the cityscape. Boston Harbor, the Charles River Basin, and Beacon Hill are the key natural elements. Although their prominence has diminished, shoreline variations and the grade changes derived from the remnants of the three original hills establish the natural topography of Central Boston and lend some variety to the urban form. Historically, Boston was strongly oriented to the water, and Beacon Hill, where major public buildings were constructed, provided a vantage of the Harbor and downtown. The loosely radial pattern of streets down from the centers of commerce and government to the waterfront still prevails, although the sense of connection

between the heart of the city and the shore is not as strong as it was the era of maritime trade.

The sense of Boston's cityscape also grows out of views to and from its tallest structures, which have created a new topography and set of vertical elements which symbolize the city. However, the crowding of towers has lessened this advantage. The influence of tall buildings on the overall urban design and on people's perception of the city will be an important consideration of development policy, as will their impacts at the street level.

Where there are views and vistas of the water, the expanses of the Harbor and the Charles River contrast with the dense urban form and stand out as key elements of the cityscape. Within the heart of downtown, the Boston Common and Boston Public Garden provide similar counterpoints to the built environment. Over the years, development has blocked many views of the water from the street and weakened the position of the Harbor as a major element of the cityscape. Development along the edges of the Common has done little to define it as a centerpiece of the city. Some new projects, such as Waterfront Park, have renewed people's interest in the water, and additional development which facilitates access and provides a mix of maritime and other uses will help to re-establish a connection between the city and the shore.

The cityscape created by the shoreline and hills and by Boston's largest open spaces, major streets, and districts create a structure, compactness, and overall character which are important to consider in preparing Central Boston's development strategy. Through urban design guidelines, the City will guide changes in Central Boston's form to protect existing views and vistas of major features, to strengthen linkages between Central Boston and its water boundaries, and to highlight central elements of its cityscape, such as the Common.

CIRCULATION NETWORKS

Changes in the circulation networks to and within Central Boston have clearly affected the form of the area and the accessibility of its various parts. As development takes place in the future, it is important to consider how improvements to the public transportation, pedestrian, and vehicular networks could be designed to enhance the overall form of Central Boston and the structure of its various districts.

Public Transportation

Public transportation systems, including rapid transit, buses, commuter rail, and ferries, significantly shape the form of the city. The location of public transportation lines and terminals determine points of access within Central Boston, influence levels of ridership, and affect the distribution of development. Transit projects can help to attract development to underutilized areas. The vicinity of South Station, for instance, is now a major focus of renewal as the station itself is being redeveloped. The integration of transit stations within development projects, such as the inclusion of the Aquarium Station in the Marriott-Long Wharf Hotel, can benefit both transit riders and businesses and offers opportunities to improve the design of existing stations. Waterborne commuter travel within the Inner Harbor and to points on the North and South Shore can provide similar chances to integrate transit with development projects; it can also improve the design of the Waterfront. The docking facilities proposed with the development of Rowes/Fosters Wharves is a step in this direction.

Guidelines which reinforce the use of public transit through the location and design of terminals and stations will be important components of Central Boston's development strategy. Equally significant, the effect of transit development on the overall form and structure of Central Boston and the compatibility of that development with surrounding areas will require careful consideration.



Pedestrian Network

Streets, narrow passages and alleyways, and interior corridors link areas of the city and establish the pedestrian network of Central Boston. The patterns of the network constitute much of the appeal of walking in the city. As people move throughout the city, landmarks, such as domes, towers, and natural features, often mark memorable and significant locations. Views and vistas of these elements help people to orient themselves in the somewhat confusing street network of Central Boston. Open spaces encountered along the way, such as Boston Common, Boston Public Garden, and numerous small parks, improve the walk. When open space is thought of as part of a pedestrian system, as it was when Frederick Law Olmsted designed Boston's Emerald Necklace of parks, the sequence of ways and spaces reinforce one another and help give structure to the city.



The maze of narrow streets constitutes part of the delight of walking in parts of Central Boston but also creates conflicts between pedestrians and motorists. In some areas, such as Downtown Crossing and Faneuil Hall Marketplace, restricting vehicular access to create special environments for pedestrians has eliminated the conflicts. In other areas, segregating pedestrians and vehicles may not be feasible or desirable: vehicular traffic can add to the activity, and hence, the public security along some streets. Employing other strategies, such as widening sidewalks, can minimize the hazards of walking downtown.

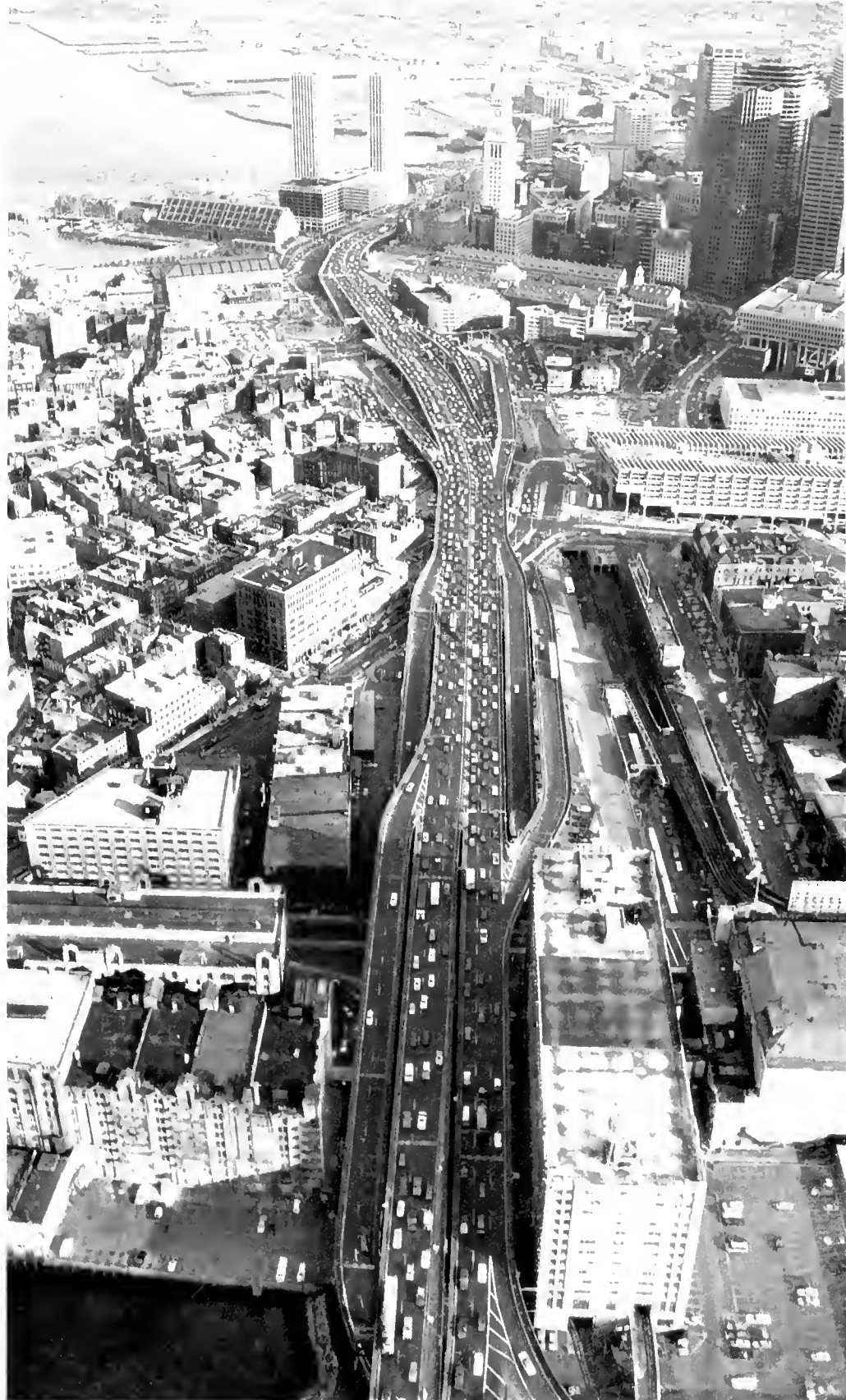
Design guidelines can reinforce the informal pedestrian network in Central Boston by encouraging developers to provide additional pedestrian connections, to strengthen the network with well-designed open spaces and interior and exterior passageways. In formulating development strategies, the effect of development on the overall quality and organization of the pedestrian network will be a major concern.

Vehicular Networks

Some major changes in Central Boston's form have occurred with improvements to vehicular networks. The construction of new highways and streets has significantly increased vehicular capacity to and within the area, but it also has cut through neighborhoods and created visual and physical barriers within the city. Having evolved over the years, downtown streets are characterized by varying widths, discontinuities, and awkward alignments and intersections. The design of local streets can be frustrating for motorists, yet contributes significantly to the city's form and human scale.

Depression of roadways and the development of air rights over them are costly but effective means of eliminating the barriers. However, development of the sizeable property created by such roadway reconstruction must be carefully planned because it has the potential itself of creating barriers. Reconstruction of the Central Artery and other major roadway proposals, including a seaport access road, a third harbor tunnel, and realignment of Northern Avenue, also may improve vehicular access and strengthen linkages to parts of Central Boston from elsewhere, opening views of the water, and improving the design of adjacent areas.

In formulating development strategies, it is important to ensure that the alteration and construction of streets and roads meet their potential for enhancing Central Boston's overall organization and accessibility and that projects designed to improve access will not disrupt the scale and character of neighborhoods and districts. As development strategies are formulated, questions will be addressed regarding how highway and parking improvements can be designed to increase accessibility without destroying the city's historic street pattern or creating inappropriate barriers within the city.



LAND USE

Public policies and private initiatives over time have determined the existing patterns of land use in Central Boston, the location of major activity centers, and the character of particular districts. New projects can create subtle or dramatic shifts in the existing patterns, influencing the vitality of some economic sectors and the organization and form of the city. To ensure that the future distribution of land use enhances the design, convenience, and diversity of activities in Central Boston, guiding the location of and mix of uses in proposed projects will be an important component of the City's development strategy.

Land use decisions in Central Boston have had both positive and negative impacts on the organization, form, and quality of life in Central Boston. The predominance of a single use in some areas has helped to establish districts and neighborhoods. The concentration of firms in the Financial District marks that as a specialized area, one that is somber in contrast to the lively ambience of the adjacent Faneuil Hall Marketplace. Government Center's predominant use, implicit in its name, sets it apart from areas with a greater mix of uses; its monumental form strengthens the district's identity. The concept of specialized districts helps people to mentally organize the city and is important in a city as complex, and sometimes confusing, as Boston.

Although particular uses distinguish some parts of Central Boston, a rich mix of uses is characteristic of most districts and neighborhoods. The diversity of uses in these areas affects their design. The configuration of a single building often accommodates a range of activities, contributing to the adaptability of the city's form. Variations at the street level enliven the public environment. When the variations establish a pattern throughout a district, such as the entrances above and below grade to Back Bay shops, such patterns help to create a distinctive identity for an area. The contrast amongst patterns throughout Central Boston helps to establish the scale and texture of the urban fabric. A diversity of uses adds to the convenience, vibrancy, and economic well-being of Central Boston and can improve some districts. Introducing ancillary activities in places dominated by a single use can make a district more convenient for people living and working there, without diluting its special character. The introduction of retail uses in areas dominated by offices, such as the Financial District, can relieve the monotony of an area or of a single building.

Various land uses generate different levels of activity throughout the day, a factor which affects the character of certain districts. In determining appropriate locations for various activities, it is important to consider how their hours of operation will affect their immediate surroundings, as well as the accessibility of goods and services in Central Boston at various times of day.



The expansion of some activities, such as those of institutions and financial and professional services, has benefited Boston's economy, but sometimes at the expense of other activities, such as housing and manufacturing. It is important for the City to guide the location of development to attain a balance between highly marketable uses and those which may be less profitable but are essential to the vitality of an urban center by directing development to underutilized areas and promoting mixed-use development. Design guidelines for Central Boston can help to ensure that development meets its potential as a catalyst for revitalization without adversely affecting existing activities.

Because of the complex effects of land use decisions, guiding the location and mix of uses in proposed projects will require careful consideration of the strengths and liabilities of existing land use patterns within particular districts and throughout Central Boston.

DISTRICTS

The concept of districts helps people to mentally organize Central Boston and to orient themselves within it. The distribution of land uses, natural features, landmarks, and block and building patterns are amongst the factors which distinguish districts and facilitate the organization of downtown Boston. As development takes place, new districts can form, existing ones can change character, less distinctive ones can gain more integrity. These changes can have positive and negative impacts on the overall organization and design of Central Boston. Consequently, controlling the impacts of development on the form and character of individual districts and the functional relationships amongst the districts and the rest of Boston is an important component of a development strategy for Central Boston. Understanding the character of specific districts in some depth and identifying design issues to address in the designated areas will be part of the next phase of Boston Tomorrow.

Because Central Boston's districts are diverse, there is much to explore in the next phase. Many of Central Boston's districts are readily identifiable. Some are characterized by the dominance of specific land uses inherent in their names; others have long-standing status as residential areas. Some areas are distinguished by a strong pattern of blocks and buildings; in other districts, physical patterns are less clear and other factors, such as ethnic character, establish the districts' identities. Still other districts are only loosely defined; their centers or subdistricts may be distinctive, but their boundaries are vague. With nearly all districts, land uses and elements of the districts' forms extend beyond their boundaries, blurring district edges. As with the city as a whole, each district can be analyzed in terms of its overall form, transportation system, and land use distribution, but it is

important that design guidelines acknowledge the inconsistencies of boundaries and subdivisions, treating the concept of districts as a very important but flexible organizing tool.

The impacts of development will vary amongst the districts. Development can make some marked improvements in a number of areas, some of which the City has identified. Plans are proposed, underway, or completed for Fort Point Channel, Downtown Crossing and adjacent properties, the East Boston Piers, North Station, and the Theater District. Guidelines for these specific districts will fit within an overall framework for Central Boston.

In some districts, the scale of development in relation to the existing urban fabric is of utmost concern. The neighborhoods have finely patterned, cohesive fabrics, preserved by tradition and the small scale of private-parcel residential use. However, relatively small changes can dramatically disrupt the texture in these districts. Preservation of the different qualities which are unique to each neighborhood are also important in these historic areas.

Each district must also be considered in terms of its context — the functional relationship and compatibility of designs with those of other Central Boston districts and adjacent parts of Greater Boston. For example, plans for parts of the Waterfront, Fort Point Channel, Charlestown, and East Boston should relate to Boston Harbor as a whole. Adjacent cities and other Boston neighborhoods have symbiotic relationships with Central Boston in terms of land use, transportation, views, and images of the city.

Design guidelines will address ways to preserve and augment the unique structure and fabric of Central Boston's districts in order to improve the legibility and organization of each district and the city as a whole.



CONCLUSION

The urban fabric of Central Boston's streets, spaces, and structures creates its distinctive character as it responds to the city's particular natural features, activity centers and districts, and movement and public space systems. Historic uses and development processes have determined the street layouts and the pattern of blocks and buildings which establish the representative scale and texture of each district. Public improvements and private development need to be evaluated in terms of their impact on the existing urban fabric and how they can enhance the structure, form, and image of the districts and Boston as a whole.

Central Boston From The Street Level

Focusing on the design of Central Boston at a smaller scale than the bird's-eye-view, this section considers how architecture and landscape architecture influence people's experience of the city at street level. Decisions made regarding the location and design of buildings and open spaces in concert shape the public environment, determining its aesthetic character and affecting public safety and comfort. Because of the importance of these individual decisions to the quality of the street environment and the overall form of the city, guidelines for the design of buildings and public spaces will be a major component of the City's development policies for Central Boston.

DESIGN OF BUILDINGS

The architectural quality of a building and its relationship with nearby buildings and open spaces contribute to the quality of the public environment and establish a sense of place along particular streets. Examples of architecture which establishes a human scale and pleasing form characteristic of the city are found throughout Central Boston. However, some development has failed to respect or enhance the public environment. Though the design of new buildings need not replicate earlier architectural styles to establish a safe and pleasant streetscape, it should reflect the human scale of Boston's past.

With the recent development in Central Boston, the scale of new buildings in relation to their surroundings has become a major design issue. A building's massing, detailing, materials, location, and use are all factors which establish its basic scale, which can range from monumental to intimate.

The massing of a building is a prominent factor in determining its compatibility with the street level environment and is one of the most

controversial elements of many development proposals. Massing (the height and bulk of a building and the proportions of major components of a development) has increased in recent years in response to the development process, real estate finance, and available technologies. Sizeable buildings afford some benefits: where appropriately designed and sited, tall buildings have become landmarks and are seen as an efficient use of urban land. Some activities, such as manufacturing, require the substantial floor area provided by large structures. However, buildings large in scale can have negative impacts at the street level, altering the character and micro-climate of a streetscape.

Architectural detailing is a second important determinant of scale and can be used to minimize the perception of a building's massing. Window courses, lintels, cornices, upper floor setbacks, and rooftops establish the vertical and horizontal lines of a building. Fenestration, ornamentation, and elements such as stairs, balconies, and arcades set up architectural patterns. These lines and patterns can help to diminish the apparent mass of a building, enliven the streetscape, complement surrounding buildings, and create an environment human in scale. In Faneuil Hall Marketplace, South Station, the old and new State Houses and City Halls, and other landmark buildings, the straightforward massing is scaled down through delicate facade treatment.

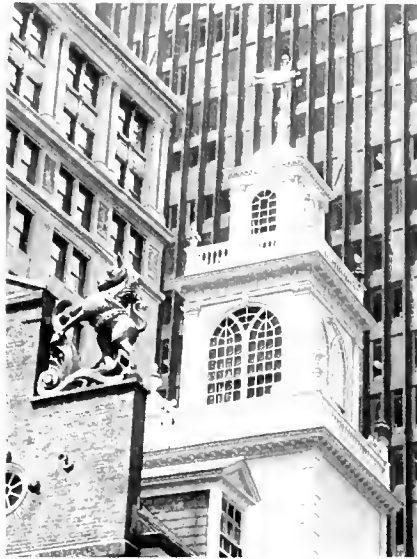
With the introduction of new building materials, such as pre-cast concrete, large expanses of glass, and metal cladding, the role of building materials in determining architectural scale and the character of the streetscape has become an important design concern. Local red brick, limestone, and granite predominated in early architecture in Boston. Many new projects, while clearly expressing modern times, fit with their surroundings partly because of the use of traditional

materials. The North End Community Nursing Home, the State Transportation Building, and Marketplace Garage are a few examples. Where new materials are used, their colors and textures, along with the detailing characteristic of certain materials, should be carefully treated to complement or enhance the streetscape.

The location and siting of a building relative to the block and building pattern of a district also affect the perception of its scale and compatibility with its surroundings. The State Transportation Building is an example of a large structure which fits with its environment in part because it hugs the street line. (It also reflects the scale of adjacent buildings through its detailing and materials). The location of large buildings relative to one another is also an issue. The negative impacts of tall buildings can be intensified, if the buildings are concentrated in a small area, as the Financial District.

Each of the factors noted above are determinants of architectural scale. Perceptions of the appropriateness of a building's scale vary according to its context, as noted above, and also according to its use. For instance, the massing, details, and facade treatment of a church is properly different from a residence and that of a commercial or office building different from a warehouse. However, each can be designed at a human scale and as an integral part of its context.

New buildings symbolize urban growth and change. Their scale and design shape the streetscape, help to define the character of the city, and consequently, are the subject of debates about the future form of Central Boston. Through its design guidelines, the City can control the impacts of new buildings on Central Boston's streetscapes, while encouraging architectural innovation and creativity. Design guidelines will address issues of scale, continuity, and facade design for new and renovated buildings.



DESIGN OF PUBLIC SPACES

A second important component of people's experience of Central Boston at the street level is the design and location of open spaces. Open spaces, such as the Esplanade, the Public Garden, Boston Common, Louisburg Square, are some of Boston's most distinctive and valued urban design elements. They enrich the color and texture of the urban pattern, provide a sense of relief from more built-up sections, and offer opportunities for passive or active recreation.

When thought of as part of the design of a building or a large development, open spaces are most successful. The urban spaces encompassed in such projects can range from large public spaces, such as parks, squares, and malls; to more intimate ones, such as courtyards, "vest pocket" parks, and alleys; to semi-public spaces within and atop buildings.

Large public green spaces, plazas, and malls are important elements in the overall urban design of the city. As with Copley Square, Commonwealth Avenue, Boston Common, Downtown Crossing, and City Hall Plaza, they are often the foci of particular districts. Development along the edges of major public spaces should enhance their prominence. Where opportunity exists to develop additional large public spaces, design decisions should be based on the place of the parks within the overall context of the city, on their relationship to adjacent buildings, on intended uses, and on ease of maintenance.

Smaller outdoor spaces off the sidewalk also influence the quality of the streetscape. Spaces within city blocks can provide a range of publicly and privately-owned amenities with varying degrees of physical and visual access from the sidewalk. The courtyard of old City Hall, the Boston Five Park, and Post Office Square Park (Angell Memorial Plaza) are representative of the range of successful small open spaces downtown. Opportunities for creating additional small parks will present themselves as development is proposed in Central Boston. In reviewing such proposals, important design considerations will include microclimate, architectural context, the continuity of the street wall, the size and shape of spaces, and the appropriateness of the space to the building. The design of a small space is most successful when it is integral with the overall project design; when it clarifies the public, semi-public, or private nature of the place; and when it lends a pleasant ambience to the streetscape.

Public and semi-public areas within and atop buildings, such as arcades, porticos, and atriums offer another set of urban spaces for Bostonians. The lobbies of hotels, public buildings, office and apartment buildings, when designed as extensions of the sidewalk, serve as semi-public, protected meeting places and transition zones between the public street and private rooms. The waiting rooms of South Station; the arcades in Mercantile Wharf, Russia Wharf, and the Old South Building; the art deco lobbies of the United Shoe Machinery Building and the State Street Bank on Federal Street provide such public interiors. The range of spaces could be expanded if, for example, rooftops were used more extensively. Interior public spaces could be used to a greater extent, if more of them related to existing pedestrian ways and open spaces. As with outdoor parks and plazas, provision of suitable interior public spaces should be an integral part of the design of new buildings.

Central Boston's urban spaces are most successful when the size, scale, and ambience respond to anticipated users and activities. Careful programming of uses and attention to landscape design are important: in public spaces of all sizes, varying types of uses can be accommodated including vendors, performing artists, organized and informal sports activities, and community events. Where appropriate, these types of uses will be encouraged. The inclusion of art in public places has long been a tradition in Boston. Fine art—statuary, sculpture, murals, sidewalk paintings, and environmental art—is accessible to the public on a daily basis, particularly in projects located in Urban Renewal areas. Fine art has been included in some other major developments as well, either at the City's request that one percent of the project's cost provide public art or because of a developer's own interest in so enhancing a project. The inclusion of art in more developments will be a component of the City's design guidelines.





THE PUBLIC ENVIRONMENT

The design and location of Central Boston's buildings and open spaces in combination establish the public environment, affecting the microclimate, the public safety, and the character of streetscapes.

When reviewing development proposals, the City is especially concerned with the potential impacts on these aspects of the public environment.

The form of buildings and open spaces affect the microclimate — the localized conditions of wind, sun, and noise. The potentially negative impacts of development on the microclimate can be tested and mitigated through careful design, as described in detail in the Environment chapter of this report.

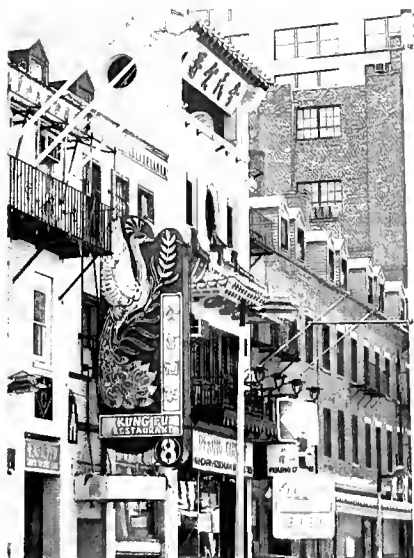
People's sense of comfort and security is a major factor in their decisions to shop, live, work, or invest in an area. Landscape details and public amenities, such as paving materials, benches, restrooms, and outdoor lighting are some factors which help to determine public safety and comfort. Some factors which make the public environment convenient and pleasant also contribute to public security. All-hours activity in adjacent buildings, street

lighting, transparency of storefronts, lack of hidden spaces and dead ends, a clarity of maintenance responsibility for spaces, and distinctions between public, semi-public, and private territories add to public security. Guidelines promoting public safety and comfort will be important in the design and review of developments proposed for Central Boston.

In addition to microclimate, comfort, and security, the designs of new developments can significantly affect the character of the urban environment. One of the ways this can be accomplished is by the addition of interesting landscape features such as overlooks, tunnels, porticos, steps and grade changes, bridges, fountains, dramatic lighting, flags and banners, and environmental art. Building facade design, signage, shops and activity along the sidewalk, special events, and seasonal decorations can add interest to a street and variety to a district. Where appropriate, design guidelines will encourage developers to include such features in new projects.

CONCLUSION

Decisions made regarding the location and design of buildings and open spaces in combination shape the public environment, determining its aesthetic character and affecting public safety and comfort. Because of the importance of these individual decisions to the quality of the street environment and overall form of the city, guidelines for the design of buildings and public spaces will be a major component of the City's development policies for Central Boston.



Central Boston On The Time Continuum

Over time economic, cultural, and technological changes have altered the physical organization of Central Boston and the design of its streetscapes, parks, and buildings. Nonetheless, much of its form is still derived from that of earlier periods. Today the form of Central Boston serves as a collage of time, giving a special character to the city while providing people with reminders of the past and a sense of continuity. Maintaining these attributes as development takes place, and providing the flexibility to respond to future needs and opportunities are important goals of the development strategy for Central Boston.

CONSERVATION OF HISTORICAL RESOURCES

Boston's architectural and topographical legacy is a critical factor in people's decisions to live, work, and invest in Central Boston. Many issues to address in formulating design policies center on protecting and enhancing the city's historical resources. A number of these issues are referred to elsewhere in this chapter, but because of the importance of preservation and conservation to the design of Central Boston, they are given special consideration here.

Boston's reputation as an historic city with a rich tradition and heritage has resulted from the unique combination of architecturally significant buildings of all eras; neighborhoods and districts that have evolved over several centuries; and its special street patterns, urban parks, and plazas. These are valuable assets. They represent an investment in labor, materials, and craftsmanship; are reminders of the processes, values, and ethnic contributions which have shaped Central Boston; and give a sense of identity and stability to Boston.

Throughout the decades, construction has added buildings to suit changing needs and styles, many of them designed in a manner compatible with the existing scale and character of the city. Preservation, rehabilitation, and adaptive re-use of distinctive structures has continued alongside new construction, often providing space more economically and quickly than new construction. Rehabilitated structures house institutions, such as the Institute of Contemporary Art and the Children's Museum, and help to restore or maintain the historic integrity of their surroundings.

The conservation of Central Boston's historical resources takes several forms. Some historic buildings have been meticulously preserved, such as the Harrison Otis House, and stand as museums of a particular point in time. Other buildings

and districts, such as One Winthrop Square, Charlestown Navy Yard, and Faneuil Hall Marketplace, have been rehabilitated to maintain the scale and structure of the past, while introducing elements which suit current needs and tastes. Preservation development has successfully merged single large new buildings, such as the Bostonian Hotel, with existing structures. These various options allow for both preserving quintessential landmarks and for knitting together the old and the new to adapt to growth and change.

However, some development has had negative impacts on the historic character of Boston. Historically and architecturally significant buildings, as well as some districts of the city, have been demolished, and many notable buildings have been insensitively altered or enlarged. The design of new storefronts in particular has often failed to acknowledge the overall character of their buildings. As new development continues in Central Boston, issues are raised concerning what buildings, districts, streets, and open spaces should be preserved, how they should be preserved, and how new development should be integrated with the existing city fabric.

Determining how to achieve a reasonable balance between conservation and development and how to protect the environs of notable public resources, such as Boston Common and Boston Public Garden, are goals of the development strategy. Guidelines can help to identify ways to successfully blend new, large structures with the city's traditional urban fabric and to minimize the negative impacts of development on valuable resources. In coordination with the work of the Boston Landmarks Commission, the development strategy and guidelines will promote the conservation of Central Boston's architectural resources and historic character and the successful commingling of new and existing forms.



ANTICIPATION OF CHANGE

Managing the effects of growth, the purpose of Boston Tomorrow, includes anticipating change. While forecasts of economic growth give some indication of how much development might be expected, unpredictable forces, cultural trends, and new technologies will also lead to alterations in Central Boston's urban design. The City cannot foresee the future, but it can strive to maintain a physical framework capable of adapting to future needs and opportunities, while preserving Central Boston's rich and complex form.

Determining the location and scale of new projects is a significant component of managing urban growth. In the past, the scale determined by building technology, the pattern of multiple buildings per block, and dependency on natural air and light controlled the size of structures and led to incremental growth and change. Today, development takes place under a different set of constraints and opportunities. New building technologies and real estate economics foster the construction of large structures, rather than incremental development. Although the City carefully considers the impacts of proposed buildings that come under its review, it has become increasingly important in a time of substantial growth and change for the City to provide an overall framework for development decisions.





CONCLUSION

The goal of the urban design strategy and guidelines for Central Boston will be to provide a framework for individual enterprise and creativity which benefits the urban design, public environment, and quality of life in Boston. The planning process will explore how development can assist in better organizing the city, enhancing the urban geography, improving circulation networks, and strengthening districts. The process will determine how to guide the design and location of buildings and open spaces in ways which complement the existing scale and character of parts of Central Boston and which protect significant historical resources.

The development strategy and guidelines for Central Boston will reflect an image of the future of the city as determined by the individuals, community groups, business people, and government agencies who participate in the open planning process. The urban design policies for Central Boston that are formulated in that process will help continue producing a city with a unique ambience and human scale, a city convenient and attractive to businesses, residents, and visitors.



Environment, Infrastructure, and Energy

The quality of the urban environment is determined in part by its immeasurable aspects, such as the aesthetics of urban form, the scale and design of structures, and the location of open space. Other elements which contribute to the quality of the environment are often less visible than the design of the city, but are measurable and directly correlate with the public health and the condition of Boston's natural resources. Environmental quality, the use of energy, and the capacity of the infrastructure are thus important considerations in the City's development policies.

New development can measurably affect Boston's environment, energy, and infrastructure depending on how traffic patterns, the location and design of buildings, and construction activity itself are controlled. Inadequate controls on the impacts of new development can degrade the environment and inhibit the City's ability to get Federal funds which have supported some of Boston's development, and transportation and park improvements in the past.

But urban growth presents opportunities to protect and enhance the quality of the environment as well. The City, through its review of development proposals and through the coordination of its efforts with Federal, State, and regional agencies, already has mechanisms in place which regulate environmental quality. Strategies and guidelines developed through this study will further assist in the City's efforts to enhance the quality of Boston's environment.

This chapter of the report is comprised of three sections. The first deals with the impacts of development on the city's environmental quality: its air, water, and microclimate — the conditions of wind, sun, and noise in small-scale locations about the city. The second describes the conditions of Boston's infrastructure: its transportation,

water, and sewerage systems. The third section of this chapter is concerned with the impacts of new development on the production and supply of energy. The background information contained in each section will help in formulating development policies respectful of the city's environmental quality.

Environmental Quality

AIR QUALITY

The air quality in Boston is affected by a number of factors related to development: traffic levels, the height and location of buildings, construction activity, energy production, and industrial processes. The Federal government has set standards for air quality and regulates some activities which can adversely affect the environment. However, other impacts need to be controlled by state and local governments. Through its development guidelines, the City will further its efforts to minimize air pollution in Boston.

The Federal air pollution regulations establish national ambient standards for six pollutants. Metropolitan Boston, an air quality region, is classified as in "non-attainment" for two of these standards: carbon monoxide and ozone levels are high.

Some factors which contribute to these unacceptable levels have originated within the city and the region. Transportation sources generate most of the carbon monoxide and hydrocarbons which are precursors to ozone formation; energy production, incinerators, construction and demolition and, to a lesser extent, transportation sources generate particulates. Ozone is formed by complex chemical reactions of precursor pollutants and travels with the prevailing winds. Much of the ozone in the metropolitan area originates outside of Massachusetts.

Because many of the elements which pollute can be controlled locally, the City is in a position to

minimize the adverse impacts of new development on Boston's air quality. Factors which the City will continue to address through its development policies include traffic impacts, the location of development, energy production, and industrial processes.

Traffic Impacts

Carbon monoxide, hydrocarbons, nitrogen oxides, and lead are major polluting by-products of automobile combustion. Traffic generates seventy percent of the hydrocarbon emissions and approximately ninety percent of the carbon monoxide emissions in Boston. Vehicular pollution is exacerbated by traffic congestion: when vehicles are running at low speeds or idling, their emissions are greater than at times of smooth traffic flow.

Carbon monoxide levels, because they are easily affected by the location and geometry of an area, are sensitive to new development. Narrow streets, flanked by tall buildings, trap pollutants between buildings and impede their dispersion. This temporary accumulation of high concentrations of carbon monoxide occurs where traffic is most congested. Measurements taken at five major downtown intersections indicate the presence of such phenomena; the eight-hour carbon monoxide Federal ambient standards are commonly exceeded at the sites.

In Boston sea breezes help to disperse the concentration of air pollutants downtown. This makes it especially important to locate tall buildings only at sites where they will not adversely affect the normal air flow.

Through its transportation policies, described in detail in the Transportation section of this report, the City has already taken steps to reduce traffic congestion, and new strategies are being planned to further the effort.

Construction Impacts

Construction activities are prime sources of particulate pollution downtown. Building demolition, land clearance and excavation, exposed aggregate storage piles and the transport of debris and fill generate dust and increase the particulate levels.

In some locations in Boston, background particulate levels are already high. To minimize the adverse effects of construction on the air quality, The Boston Air Pollution Control Commission (BAPCC) has established regulations to control the particulate pollution that renovation projects can generate. BAPCC also controls the handling of asbestos in demolition and reconstruction.

Impacts of Energy Production

With the rising costs of producing energy with Boston Edison Company's electrical system, some commercial customers have switched to private fuel-burning systems which have the potential to increase air pollution.

Proposed Federal regulations favoring cogeneration projects could result in the installation of large diesel or gas turbine-powered generators in Central Boston. Although cogeneration facilities reduce total fuel consumption and pollution by utilizing waste heat, they also change the nature, location and type of pollution generated. The change in type of pollution from these facilities is difficult to quantify, as is the cumulative effect upon air quality standards. At this time, the effects of cogeneration will need monitoring.

Industrial Impacts

Industrial development in Central Boston generates little air pollution, but BRA and the BAPCC have designed strategies to encourage economic growth in manufacturing while minimizing air pollution emissions.



BAPCC Controlled Trading Program is applicable to both new and existing development. Developers seeking to locate in nonattainment areas can use the program to build in a growth margin for additional development. By reducing pollutants beyond what is currently required, developers can credit the surplus reductions for future growth.

To assist new developments, the BRA is planning to develop an emission reduction credit bank. Banked reductions will include those generated from reductions at City facilities; those conveyed to the City; and those received from facility shutdowns. Applicants will be able to petition for use of these banked reduction credits to offset emissions from new development. Priority will be given to those projects which reinforce the City's development policies.

Mechanisms already in place, such as the City's transportation policies and the Controlled Trading Program, will enhance the quality of air in Boston. Development guidelines which address the impacts of urban growth can also help to reduce the amount of pollution, facilitate air flow, and disperse pollutants. In concert, new and existing strategies will enable the City to achieve Federal and State air quality standards.



WATER QUALITY

Both Boston Inner Harbor and the Charles River Basin add a dimension to Boston that only a few other cities in the country can duplicate. Historically, the Inner Harbor has helped to strengthen the local economy, serving the needs of fishing, manufacturing, and other commercial sectors. Both bodies of water enhance the aesthetic appeal of the city and provide recreational opportunities for residents and visitors. Poor water quality can threaten these assets.

The City, the Metropolitan Area Planning Council (MAPC), the Metropolitan District Commission (MDC), and Federal and State agencies have taken steps to improve the quality of water in metropolitan Boston. Their actions have already led to improvements in the Inner Harbor and the Basin, but it will take time and additional efforts to meet the Commonwealth's water quality standards, which set acceptable levels for various water uses.

The water quality problems which the City and other governmental agencies are addressing encompass the chemical and aesthetic properties of the City's water resources. Chemical and aesthetic pollution in Boston's Inner Harbor has resulted from combined sewer overflows, stormwater runoff, sewerage processing sludge; from debris; from oil and waste of boating and industrial activities; and from filling and dredging. In the Charles River Basin, combined sewer overflows and saltwater intrusions have resulted in water pollution.

The MDC has taken steps to reduce pollution in Boston Harbor and the Charles River Basin. With the assistance of Federal, State and City environmental agencies, the MDC is developing several projects to improve the metropolitan sewerage system. To control the impacts of combined sewerage entering the Charles River, the MDC has constructed a sewerage control and

treatment facility in the Basin, adjacent to the new Charles River Dam which prevents saltwater intrusion. The facility and the dam should help to gradually recover and maintain the quality of water in the Basin. (The Infrastructure section of this report describes strategies used to reduce pollution of the Harbor from inadequate sewerage facilities.)

The Army Corps of Engineers has proposed removing floatable debris and dilapidated structures from Boston Harbor, but negotiations over whom will bear the cost have delayed implementation.

To expand the usable land area of Boston, between the 1700s to the present, the City has periodically filled areas of Boston Harbor and the low lying marsh areas and alluvial plains in the Back Bay. New land created in this manner includes parts of South Boston and East Boston, Logan Airport and Bird Island Flats, and the Back Bay. Land fill has increased the city's mass to more than three times its original size. Filling has reduced the size of the Harbor and the Basin and contributed to water pollution. Construction in recent decades on filled land in the Back Bay has caused some structural damage to buildings. The lowered water table has exposed the pilings supporting older buildings; unless the water table is maintained at five feet or higher, these pilings quickly rot.

In accordance the Federal Wetlands Protection Act, Massachusetts established regulations governing the filling and dredging of waters. Because Boston Harbor is a unique natural and economic resource, the City seeks to minimize fill operations, particularly for non-maritime uses. The City considers the impacts of such operations as part of its development review process.

As the City continues to formulate development policies, protection and enhancement of Boston Inner Harbor and the Charles River Basin will remain an important priority.



Microclimate: Noise, Wind, Sunlight and Shadow

Noise

In urban environments, daily transportation, commercial, and industrial activities all generate background, or ambient, noise. Occasional activities, such as air traffic and construction work, create intermittent and louder noise. Ambient noise levels have increased in some downtown areas which has created the need to control activities generating noise, or to design buildings to mitigate the impacts of unavoidably noisy activities.

In Boston some strategies have successfully reduced noise levels downtown, and regulations exist which establish acceptable levels of noise. The Boston Air Pollution Control Commission adopted such regulations in 1972 and set noise level standards for residential, commercial, and industrial zones.

The BRA has worked closely with the Massachusetts Executive Office of Environmental Affairs to reduce noise levels generated by operations at Logan Airport, primarily by prohibiting the use of Logan's facilities by aircraft that violate Federal noise emissions standards. Massport also has established procedures that consider noise levels as one of the criteria in the allocation of the use of runways, in addition to several other noise abatement procedures.

Federal noise standards, administered by Federal and State agencies through the environmental review process, along with the regulations of BAPCC, help to control the adverse impacts of new construction on the City of Boston.

Wind

Boston is a windy city with an average annual wind speed of 13.3 miles per hour. Gale winds of thirty-two miles per hour or higher are expected at least one day each month, and gales are both more frequent and severe in the winter months. Because the presence of tall buildings can increase wind velocities, affecting the microclimate along adjacent streets and sidewalks, it is important to minimize the adverse effects such buildings can have on the already windy streets of Boston.

Solutions to wind problems include architectural modifications, landscaping, and built wind barriers. Appropriate design modifications used in Boston and other cities have included remassing of major building elements, lowering proposed building heights and changing building widths, as well as changing the proposed orientation of some projects. Add-on architectural solutions useful in controlling wind effects include enclosed arcades and open canopies, or wind screens such as walls, fencing, and plantings. Other methods, such as prohibiting pedestrians from high wind areas or installing safety warnings, do not remove the problem and are therefore unacceptable solutions in Boston.

To determine pedestrian wind conditions expected from a proposed major construction project, wind tunnel testing is conducted. The tunnel simulates the interaction between the built environment and statistically predicted wind directions and velocities throughout the year. The simulation can also test the efficiency of proposed design modifications. The City currently requires wind tunnel testing for proposed projects which could have severe impacts on the microclimate.

Sunlight and Shadow

Shadows cast by tall buildings vary with building height, time of day, and seasonal angles of the sun. Although modeling can illustrate the shadow effects accurately, models do not illustrate the impacts of those shadows on people. Impacts can seem most significant on warm days when workers, shoppers, and visitors want to enjoy downtown open spaces, as well as on winter days when the warmth of the sun is especially welcome. Shadows, in addition to reducing the attractiveness of the city's streets and parks, can hamper efforts to promote solar energy. With increasing concern over fossil fuel shortages, more interest has developed in solar alternatives. It is the City of Boston's practice to preserve access to sunlight in sensitive areas and to work with developers to mitigate the impact of building shadows.

Conclusion

Urban growth can measurably affect the environmental quality of Boston, but strategies taken by the City in coordination with other governmental agencies, have gone far to improve the quality of the City's air and water and to mitigate the potential for adverse impacts of development on the microclimate. New strategies and guidelines will assist this ongoing process.



Infrastructure

TRANSPORTATION

More people are moving about Boston than ever before and with the growth of downtown, the number of people driving, walking, biking, riding the T, and moving goods within and around Central Boston will increase in the coming decade. The linkage between development and the need for expanding the capacity of the city's transportation system has not been ignored: it is an important consideration for both the City and the Commonwealth.

The Boston area has led the nation in development of innovative transportation policy. The landmark Boston Transportation Planning Review (BTPR), created in 1970, was established to re-evaluate existing plans and policies and to provide the basis for a regional transportation program. The principal policy determination made as a result of BTPR was that no new expressways would be built within Route 128. Because additional expressways would create negative impacts, BTPR policies encouraged alternative improvements to the transportation system. The policies, reinforced by Federal, State, and local policies and programs, emphasize regional transit improvements, discourage highway expansion, and limit traffic entering downtown by restricting parking.

Strategies to mitigate congestion and environmental degradation should not inhibit access to Central Boston, discouraging future development. Rather, as more development takes place, strategies should maximize the ways in which new projects can improve the transportation system and minimize the adverse effects of urban growth. Transportation studies are already underway or have been completed recently, and the City currently follows specific development-related guidelines to improve travel in Boston.

The basic objectives of the City's current transportation policies for Central Boston are to:

- a) reduce the number of vehicles entering downtown, particularly during peak hours;
- b) promote the use of public transportation, bicycles, and higher-occupancy vehicles;
- c) avoid conflicts between different transportation modes; and
- d) separate through trips from trips destined for downtown.

The City attempts to achieve these objectives in part through the BRA's review of development proposals. In its review, the BRA evaluates a proposal's potential impact on the following: traffic and circulation, parking, transit, goods movement, and pedestrian movement.

Traffic and Circulation

As the City continues to develop transportation strategies, it faces a system that is already congested. Even a decade ago, the regional highway system was operating at more than capacity during rush hours. Since then, traffic volume has grown by over one percent annually. The Massachusetts Department of Public Works estimates that it will continue to grow, at 0.5 percent annually, for the next twenty years.

Travel during peak commuting hours remains frustrating, irrespective of the mode of transportation. Downtown streets and arterials are crowded, as is mass transit. Although traffic will never flow as smoothly at rush hour as it does at less crowded times, conditions could improve with localized or large-scale modifications. The City is currently conducting comprehensive studies on parking and traffic flow issues, which will result in measures to alleviate these problems.

New development, though it generates additional traffic, often provides opportunities to improve the roadway system, because of demolition required for projects. Street realignment, changes in curb cuts, sidewalk widening, and street discontinuances are the types of improvements made possible by new development.

Transit could expand the capacity of the system, without dramatic changes to the transportation infrastructure. The City attempts to steer the location of developments expected to generate large numbers of people to areas with direct transit and/or expressway access as much as possible. Implementation of programs such as staggered working hours, four-day work weeks, car and vanpools would reduce peak-hour demands on the system.

Large-scale changes to the transportation system are currently under study by the state. The Third Harbor Crossing and reconstruction of the Central Artery are two major projects proposed to improve the most congested section of roadway in the metropolitan area. The Third Harbor Crossing project would divert traffic destined for Logan Airport and the North Shore from the Artery to a new tunnel. The project to reconstruct the Artery proposes to increase that road's capacity by one-third in each direction, and it would improve access to the Artery by altering the ramps. Each project could alleviate traffic congestion in Central Boston, but should only be built if it will not adversely affect residential areas.



Parking

During the past decade, the City has implemented a number of parking policies to discourage the adverse impacts of development on transportation and to improve existing conditions. Policies, some of which are coordinated with the BRA and the Boston Air Pollution Control Commission (BAPCC), aim to limit the amount of downtown parking, thereby discouraging the use of automobiles for travel within Central Boston and limiting the amount of land taken up by parking facilities.

Under the current zoning code, parking is now a conditional use in a Restricted Parking District, and approval for any non-residential parking facility within the district must be granted by the Zoning Board of Appeals.

To facilitate residents' access to their downtown neighborhoods, resident permit parking was instituted, and parking regulations are strictly enforced. Developers of new and rehabilitated residential structures and hotels are required to provide parking on the basis of the number of units and their location.

A parking freeze in Central Boston was instituted in 1975, in part to meet the Federal Environmental Protection Agency's air quality standards. The freeze set a ceiling on the number of commercial parking spaces, limiting the number of spaces (35,503) to those in existence on October 15, 1973. To modify or construct new commercial parking facilities in this area, parking operators must have a Parking Freeze Permit, issued if an equivalent number of off-street parking spaces have been eliminated within the freeze area and if the proposal adheres to BAPCC regulations. The freeze currently applies only to spaces open to the general public where cars are parked for a fee. If the general public is excluded from a facility, for example in resident, guest, or employee-only parking, an exemption from the freeze can be obtained.

The City's parking policies have fostered parking improvements simultaneous with substantial new development, but the City is re-viewing its policies to determine how to accommodate future development, to provide sufficient short-term parking for retail customers, while minimizing traffic congestion. The City's "Parking Supply and Demand Study", the first phase of which was recently completed, is a step in that direction.

Truck Traffic

Trucks generate over five percent of all traffic in Central Boston and slightly more than that in off-peak hours. While trucks and delivery vehicles are necessary in the downtown, on-street deliveries and trucks backing into loading bays can impede pedestrian and vehicular traffic flow. The zoning code requires off-street loading facilities for buildings to minimize such interference. City policies relating to the movement of goods include the separation of truck traffic and residential traffic and limits on the hours for delivery within Downtown Crossing.



Mass Transit

Systemwide, MBTA patronage has remained fairly constant since 1975, reversing the decline begun in the early 1950s. Six-hour peak ridership into Central Boston is estimated at 365,000 trips. Rapid transit ridership accounts for the majority of the trips; express and local bus and commuter rail account for a lesser proportion of ridership. Private bus patronage has risen sharply over the last several years. The private bus share of the market should continue to expand as parking rates and the time it takes to drive to Central Boston rise. The opening of a bus terminal at South Station in 1985 will also boost private bus ridership.

Most transit lines basically operate at capacity during the peak hours. Capital improvements underway should improve current conditions and increase ridership. Projects include the extension of the Red Line to Alewife with a two thousand car garage; Southwest Corridor's new construction between South Cove and Forest Hills; a new Back Bay station for commuter rail and rapid transit; the South Station Transportation Terminal for intercity buses, commuter rail, and rapid



transit; platform extensions to accommodate longer trains at stations along the Orange and Red lines; and the rehabilitation of stations downtown.

Despite all the construction activity, funding for public transit, especially for operations, is diminishing. Lack of funds may ultimately result in a reduction in ridership. Because transit currently carries two-thirds of the commuter traffic, transportation and environmental policy on all levels is directed towards expanding the transit market share with whatever resources are available. Maintenance and improvement of the system is critical to attaining these goals.

Locating new development near transit terminals, integrating transit stations into the design of new projects, and improving pedestrian connections between transit stations and the street are all strategies which the City can apply to foster the use of mass transit.

Providing an alternative for commuters, water-based regional transportation could help to alleviate congestion and to conserve energy. Some vessels already transport commuters from Hingham to downtown, but docking facilities are currently inadequate. To promote the use of ferries, the BRA has stipulated in its developers' kit that docking facilities be part of the new development planned for Rows/Fosters Wharves. If redevelopment along the waterfront were to include and improve docking facilities, a water-based inner harbor transit system could serve as a major source of transportation, linking the Charlestown Navy Yard, East Boston Piers, the John F. Kennedy Library and Columbia Point with Boston's downtown.

Boston has recently made a number of improvements in transportation downtown. As development proceeds in the next decade, additional strategies and guidelines can make the most of the opportunities which redevelopment presents to facilitate access to and within the City.

WATER SUPPLY

Although Boston's demand for water does not exceed its safe yield now, the city's water usage is expected to average 153 million gallons per day (mgd), with occasional demands for 161 mgd by 1990. Regionally, the current demand already exceeds the safe yield by fifteen mgd. With the per capita demand growing annually, MDC predicts a shortfall of seventy mgd systemwide by 1990.

The City and the MDC are implementing strategies to improve and conserve the supply of fresh water; these measures will help to minimize the effect of new construction on the already overburdened water supply system. The city receives its fresh water principally from the Quobbin, Ware, and Wachusett reservoirs in Central Massachusetts, as do the forty-three other communities supplied with water through the MDC. Boston, the largest municipality in the group, uses the most water; the City's efforts to promote water conservation could benefit the region.

The authority to improve the water supply system and to minimize additional demands on it is shared amongst State, regional and local agencies: Massachusetts Department of Environmental Quality Engineering (DEQE), MDC, and the Boston Sewer and Water Commission (BWSC). The State also attempts to control additional demand through its building codes, the City through its development review procedures. Each of these entities can play a role in promoting water conservation, an important strategy for managing the future water supply. The 1977 Massachusetts Water Supply Study estimated that water consumption could be reduced by fifteen to twenty percent over ten years through a program of public education, plumbing code revisions, price structure, and public ordinances.

BWSC, which manages the distribution and service of the water supply within the city, has the authority to employ several strategies to promote conservation. It sets user prices, subject to MDC approval. In as much as price can govern demand, price-setting can serve as one conservation-promoting tool. BWSC may also institute other conservation measures of its own design or those initiated by MDC. For instance, several major sources of unrecorded water usage include leaky water mains, meter slippage, unmetered use, and hydrant use. A primary measure now being implemented by BWSC attempts to eliminate one of these sources; its leakage detection and repair program has saved approximately fifteen mgd in the past few years.

The MDC is currently working toward increasing the capacity of the system. However, it will require at least five years to bring one new reservoir on line. This first additional source, now under consideration by the MDC, would increase the safe yield of the system only enough to meet the current demand. An additional five years will be required to further supplement the system to meet the 1990 projected demand. At the present time, there are no definitive data on the demand or supply of water beyond the 1990s. However, the MDC is developing reliable projections of demand for the year 2020 and is studying methods of both increasing the safe yield of the system and minimizing the demand for water.

The State can influence water consumption through DEQE, which has the authority to institute emergency bans on water usage, and through State building codes. In 1978, the Massachusetts Plumbing Code was changed to require low flow showerheads in new construction and renovations. The low flow showerheads could reduce individual household consumption of water by twelve percent.



Local governments have several options for promoting conservation that are unavailable to the State and MDC. The City can allocate water to different users within the municipality, and it can enact ordinances related to water conservation. Through the authority of BWSC, the impacts of new development on the water supply system can be mitigated. Measures taken by BWSC to improve the sewerage system, described in the following section, will also help to conserve water.

SEWERAGE SYSTEM

Boston's sewerage system is approaching its centennial. Built in 1884, the Boston Main Drainage System included twenty-five miles of main and intercepting sewer lines. As the city grew, additional lines were added to the system. The Main Drainage System now includes the Boston Main Interceptor, the West Side Interceptor, the East Side Interceptor, and several smaller interceptors which flow into the Main Interceptor. The system carries combined sanitary sewerage and storm drainage from the city and adjacent towns which have connected to these systems to accommodate commercial and residential development.

Because of its age, major portions of the system — especially the East Side Interceptor and Deer and Nut Islands sewerage treatment facilities — are inadequate to accommodate the volume of flow during peak demand periods. When the hydraulic capacity of the mains is insufficient to handle the volume, combined storm water and raw sewerage discharge directly to Boston Inner Harbor and Charles River Basin. Combined sewer overflows (CSOs) are the central cause of pollution in the Harbor and Basin.

Inefficient treatment facilities create other problems. While the design capacity at Deer Island is not yet exceeded, the peak capacity can be surpassed during periods of moderate rain, as well as during periods of excess demand. The capacity of Nut Island primary treatment facility has been exceeded for several years.

Primary treatment — screening, sedimentation, and skimming — removes virtually all settleable solids and a portion of other pollutants, including toxic metals in suspended solids and nutrients which create a high biological oxygen demand. The effluent or liquid by-product of the process is chlorinated to kill bacteria and is then discharged into the Harbor. The

sludge or solid by-product is further treated to reduce organic solids and then discharged into the Harbor. Although the sludge and effluent have undergone treatment, they still pollute. Disposal of the sludge from Deer and Nut Islands has caused oozy sediments containing heavy metals to accumulate on the floor of Boston Harbor and has contributed to the contamination of shellfish.

Leakage from old lines is another major problem with the sewer system. The leaks allow infiltration of fresh and seawater in both the local and interceptor sewers and thus exacerbate the CSOs and the demand for treatment by increasing volume.

Development downtown could increase the burden on the sewerage system and detract from the water quality of Boston Harbor and the Charles River Basin, unless steps are taken to improve the system and conserve water. Already several programs are planned and underway to upgrade the capacity and efficiency of the system, as described below. However, there is a strong need for concurrent water conservation measures in the city to reduce input to the system.

The MDC is undertaking major projects to meet the goals of Federal and State legislation which govern water pollution, including pre-treatment to remove toxic wastes, replacement of the Boston Main and East Side Interceptor sewers, control and treatment of combined sewer overflows, upgrading the Deer Island and Nut Island treatment facilities, and management of the primary sludge from those facilities.

The City and BWSC have also taken steps to improve the sewerage system. As part of its Urban Renewal Program, in the late 1970s the City set up an extensive sewer separation program, supported by Federal funding. The BRA initiated design and construction of separation projects for the Charlestown, South End, South Cove, and

Downtown-Waterfront-Faneuil Hall Urban Renewal Projects. Work on the projects has continued through the coordinated efforts of the BRA and BWSC. The separation is nearly complete downtown; but dry weather overflows, the remaining CSOs, and the insufficient capacity of the East Side Interceptor still cause water pollution.

The BWSC plans to increase the system's capacity by replacing the East Side Interceptor, but design and construction may take three to four years. To deal with the Interceptor's current inadequacies, the BWSC has recently required major new construction, such as Exchange Place, Devonshire Towers, and the Marriot Long Wharf Hotel, to install waste water holding tanks. The tanks retain sewerage during times of peak demand on the system and discharge it into the Interceptor during off-peak hours. If a development could not accommodate such a requirement, BWSC has the authority to deny the sewer hook-up permit, a prerequisite for a building permit. In general, any development within the East Side Interceptor drainage area that would produce over ten thousand gallons per day of waste water, would require a holding tank with a capacity for approximately sixty percent of the average daily flow.

The combined sewer overflow and the dry weather overflow controls, along with the replacement of the East Side Interceptor, should bring the quality of water in the Inner Harbor up to most of the Massachusetts Water Quality Standards. However, standards regulating dissolved oxygen will not be met because separated storm water runoff still carries a significant volume of pollutants including bacteria, heavy metals, and suspended solids.



Energy

Concern for energy efficiency is a pressing economic problem for Boston today. The city depends heavily on imported fossil fuels to meet the operational, climate-control, production, and transportation needs of all sectors of the local economy.

Only a few years ago, energy was readily available and relatively inexpensive, hence it was not a factor in development decisions. Foreign oil has quintupled in price since 1973, rising with each supply interruption. With the cold climate and fragile supply systems, Boston, along with the rest of the Northeast, was especially affected. Fuel expenditures have risen in Boston, resulting in a drain on the local economy. In 1978, close to seven hundred million dollars was spent on energy consumption in the city. Today, expenditures exceed 1.4 billion dollars, and approximately eighty-five percent of that amount left the local economy in 1981 alone to pay for oil and oil distillates, gas, coal, and uranium. Today energy impacts are a factor to consider in formulating development policy. In contrast to other areas of the U.S., energy costs more for Massachusetts consumers. Manufacturers in the Commonwealth pay over fifty percent more for energy than the national average. Development guidelines promoting energy-efficient siting and building design could help to lower the costs of living for local residents and the costs of operating for local businesses.

Boston's Energy Profile

In Boston residential uses account for one-quarter of the City's annual energy consumption; commercial and institutional sectors account for

over fifty-five percent. In each sector, except for industry and transportation, the largest amounts of energy are needed for space heating purposes. In residential buildings, water heating is the second most important end use. In the commercial and municipal sectors, lighting is second most important. The industrial sector uses most of its energy to generate process steam. If Boston's demand distribution remains unchanged, commercial space heating, air conditioning and lighting will account for most of the energy used in Central Boston, and residential space heating, and air conditioning will follow in importance.

In all sectors, oil is the predominant fuel consumed (55.6 percent). In the non-residential sector, however, electricity represents a larger proportion (42.7 percent) of the total energy costs than any other single energy source.

Boston's need for electricity is met primarily by the Boston Edison Company (BECo), and for gas by the Boston Gas Company. BECo owns Boston's steam district heating system. The system is old, relatively inefficient, and no longer competitive with other energy sources. By contrast, Northern European communities, where efficient district heating systems have been in use for the last twenty years, consume forty to sixty percent less fuel for heating, cooling, and electricity than American cities. A forty percent reduction in Boston's space heating and hot water bill would lead to an annual savings of approximately three to four hundred million dollars annually (1981 dollars). For the short term, heavy reliance on electricity has serious economic implications because BECo is still approximately sixty percent dependent on imported oil.

Planned conversion of much of the electric generation capacity from oil to coal, nuclear, hydro, and wood could reduce BECo's oil dependence to approximately ten percent by 1987. Because of its high cost, it is of critical economic importance that Boston consume electricity as efficiently as possible in order to minimize the City's energy dollar outflow and reduce its vulnerability to supply interruptions.

In the short-term, Boston is unlikely to increase its reliance (17.5 percent in 1978) on natural gas as a fuel source. Proposals for new facilities to expand service are in preliminary stages. Currently, gas supplies for commercial and industrial uses in Boston are uncertain. Boston Gas is dependent on liquefied natural gas (LNG) from Algeria, a source of questionable stability. Even brief interruptions of Algerian LNG, such as the weather-delayed shipments in 1981, would contribute to local shortages of gas. In the event of a domestic gas shortage, the Federal Energy Regulatory Commission would curtail supplies to commercial and industrial customers before depriving higher priority residential and institutional customers. Regardless, even if natural gas continues to cost less than other fuels, natural gas customers will pay much more than they do currently. Boston Gas expects to expand its supplies and serve more customers in the next four years. However, uncertainties in availability and price of natural gas give Boston Gas an unpredictable role as an energy source for new development in Boston.



Energy Efficient Site And Building Design

One of the most effective mechanisms for the City to use in promoting energy efficiency is controls on the siting and design of buildings. As noted in the sections on wind, shadow, and noise, development can affect the microclimate in localized areas, which in turn affects energy consumption. Site and building design can minimize the undesirable impacts on the microclimate, take advantage of the site's desirable characteristics, and thus limit the amount of fossil fuel-derived energy required. Careful controls of building mass, configuration, orientation, fenestration, exterior wall design, and color can make a difference in the city's total fuel consumption.

Choosing the proper controls to achieve optimal energy savings requires careful analysis of specific projects. In many cases, trade-offs among the array of design opportunities are required. Within a framework of general guidelines, there needs to be flexibility in order to achieve the optimal savings for each development. General guidelines can be applied to the process of designing a building for Boston's climate and energy system.

Building Orientation

Building orientation significantly affects energy requirements. The path of the sun, local wind patterns, and the positions of other structures are of particular concern and need to be considered carefully in relation to projected building uses.

Boston, in comparison to many other American cities, can benefit from the solar energy available and reduce Boston's fossil fuel dependence. To do so, new construction should optimize solar exposure (shade in summer and gain in winter); minimize wind turbulence, especially at the street level; minimize exposure to prevailing winds; and minimize adverse shadow and wind impacts on neighboring parcels.

Building Massing

To reduce the amount of energy lost through conductance, the most efficient building shape is a cube. Relative to building volume, this shape has a minimum of exposed surface through which unwanted heat loss or gain could occur.

As buildings increase in height, they are subject to significant internal drafts; consume substantial amounts of energy because elevators can account for as much

as seven percent of the total consumption; and can create wind turbulence which affects neighboring buildings.

The creation of internal drafts, known as the chimney effect or stack induction action, can disrupt the internal climate and reduce the efficiency of air conditioning. Drafts down stairwells and shafts can suck conditioned air out of working areas, creating the need for more heat or air conditioning. Wind turbulence created by tall buildings can increase energy consumption in neighboring buildings because the turbulence heightens thermal losses. Because of these potential impacts, buildings should be massed to minimize the amount of exposed building surface, internal draft effects, and external wind turbulence.

Landscaping

Boston is one of the windiest cities in the country. This poses problems for energy-conscious builders because high winds generate a greater demand for energy. For example, a house of conventional construction has 2.5 times the heating load in a nineteen mile per hour wind as in a three mile per hour wind at the same temperature. Wind analysis and landscape



planning can reduce building energy consumption, while increasing the comfort of pedestrians and inhabitants.

Shading can reduce temperatures of sunny surfaces by twenty to thirty degrees Fahrenheit. Similarly, ambient air temperatures over paved surfaces can be higher than those over planted areas by as much as thirty-five degrees during summer months. Therefore, reducing ambient air temperatures around buildings can lead to significant reductions in the cooling load.

This can be achieved by landscaping sites so that as much of the site's paved surfaces and the building surfaces as possible are shaded by deciduous trees; as much of the site as possible is planted with grass, particularly immediately around buildings; and evergreen windbreaks are placed on the north and west sides of buildings at appropriate distances.

Life-Cycle Costing

Life-cycle costing (LCC) may be the single most effective device available for insuring both energy savings and optimal capital allocation. This costing method allows the computation of total cost of ownership over the expected life span of an asset; incorporating initial cost, predictable operating and maintenance costs, ultimate disposal value, and quantifiable benefits to the owner. In many instances, operating and maintenance costs over the long life of a building far exceed initial costs. By evaluating a range of energy system and design alternatives, LCC could help identify options which will both reduce life cycle costs to the benefit of the city and be affordable to the developer.

Energy System Technologies

Though not all energy systems are cost-effective for all locations, some systems can perform well in Boston and reduce the city's total consumption of fossil fuels. They include solar and wind power, cogeneration, district heating, heat pumps, and cable-monitored systems regulating energy use in large buildings. Some are already in use in Boston. Solar systems on some houses in the Fenway and other

areas provide energy for heating space and water. Boston Edison currently operates a district heating system downtown, but it is old and inefficient. Certain areas of Boston are more appropriate for district heating than others. The capital costs of installing district heating are high, so the system would be most effective in small, dense areas where the occupants have extensive and diverse energy demands. For instance, district heating would be effective in the Fort Point Channel area. Cable-monitored systems which are capable of monitoring and controlling energy consumption in large buildings offer another prospect for conserving energy in new projects.

While the City cannot control all the factors affecting energy supply and demand, it can promote energy efficiency through development guidelines. Site and building design controls could reduce energy consumption. The City could also promote the use of alternative energy systems, protecting solar access in appropriate locations and promoting systems appropriate for specific areas.



The on-going and substantial physical renewal of Central Boston is manifest by recent excavations, construction cranes on the skyline, and the completed buildings themselves. The economic recovery which has accompanied this redevelopment is significant, especially at a time when the national economy has not fared well.

Maintaining the current vitality of Central Boston's economy, achieving the growth projected throughout the decade, and managing future changes downtown for the benefit of all of Boston presents many challenges for the City. The development issues which confront the City over the next ten years, as outlined in this study, are complex. Resolutions will require the collaboration of public and private entities city-wide. The range of perspectives, expertise, and advice that public agencies, private groups, and individuals can offer will assist the Boston Redevelopment Authority as it initiates the second phase of Boston Tomorrow.

The second phase will result in a development strategy and specific guidelines for managing growth and change in Central Boston over the next ten years. Reflecting major sections of this report, the guidelines will address four categories: economic development, residential development, design, and environmental quality. A preliminary draft of the guidelines will be available for public review in the fall of 1983.

To assist in guiding the development of Central Boston, the BRA encourages interested groups and individuals to contribute their ideas and insights in response to the information contained in this report and to the draft guidelines. Opportunities for public review and participation will be presented as various policy options are considered. Through a collaborative effort, one which embraces the diversity of interests in Boston, the City can work toward ensuring that the economic growth and physical development of Central Boston will expand employment and housing opportunities, improve Boston's fiscal profile and investment climate and enhance the unique character and quality of life throughout the city.



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